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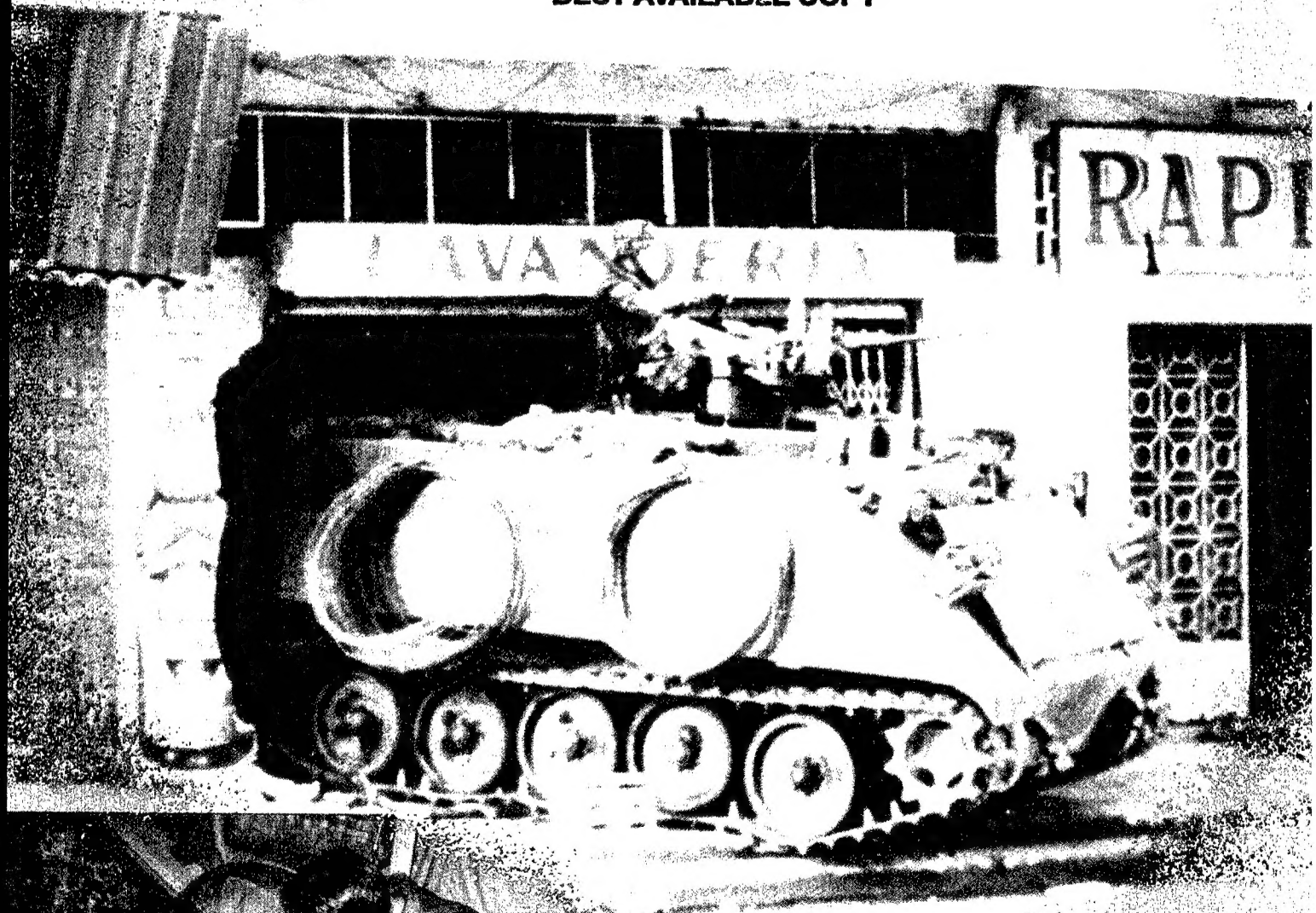

MEDICAL WARRIORS IN WAR AND PEACE

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CONTENTS

COVER: **Medical personnel were recently involved in Operation Just Cause where they once again proved their essentiality to successful combat. (NOTE: Medical pictures on the cover and on pages 3 and 5 are courtesy of 908th Medical Admin Office at Maxwell AFB AL. They illustrate medical personnel in action during recent deployment.)**

(We extend a special thanks to the 908th Tactical Airlift Gp for furnishing the picture used on the cover of our Spring 1990 Issue.)

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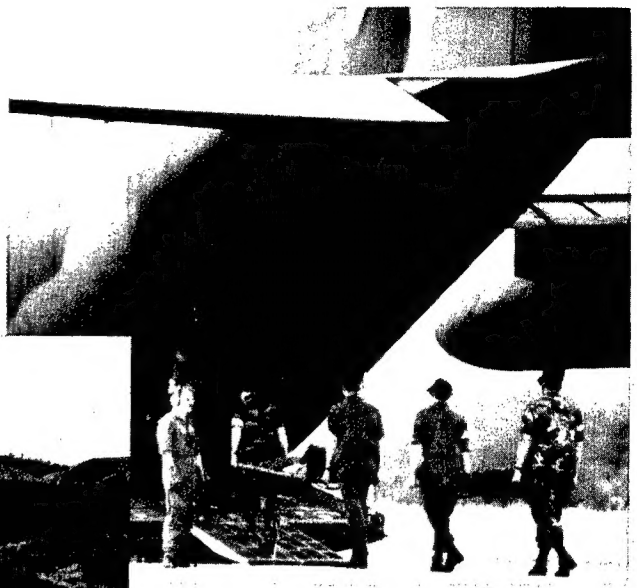
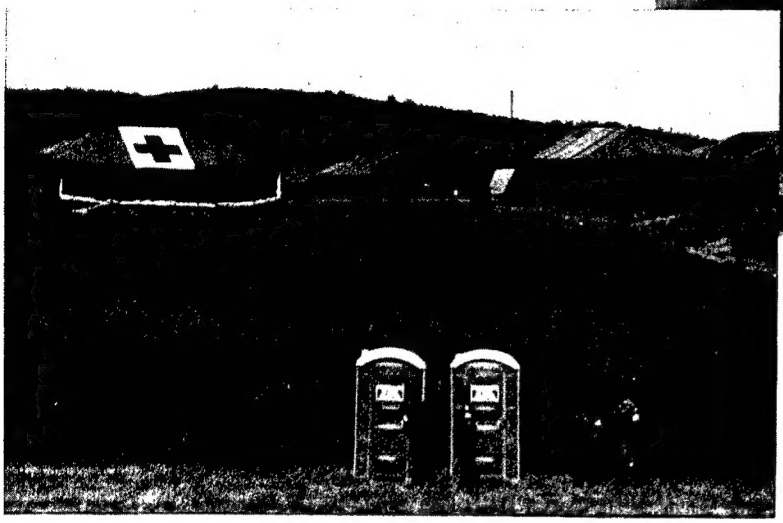
MEDICAL WARRIORS—
An Elite Group





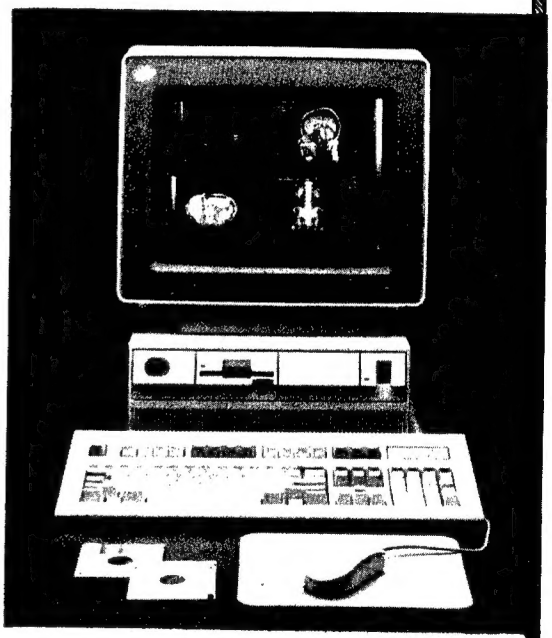
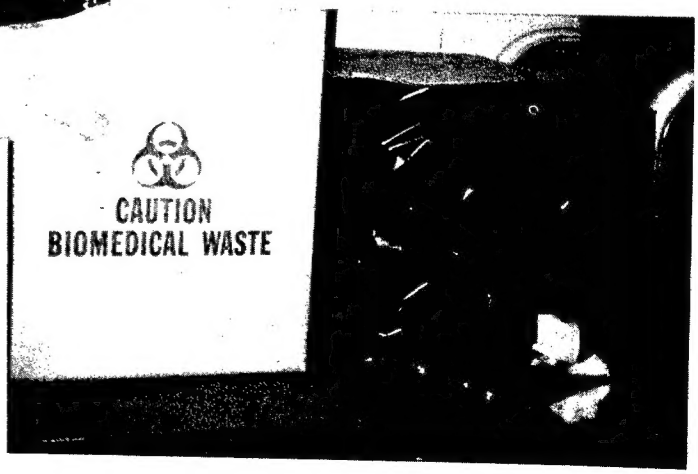


Photo courtesy of GE Medical Systems



Operation Just Cause: A Medical Logistics Perspective

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Over 25,000 American military men and women participated in Operation Just Cause, efficiently completing their mission to seize Panamanian dictator, Manuel Noriega; neutralize the Panamanian Defense Forces; safeguard American civilians; protect the Panama Canal; and restore democracy to the Panamanian people. Though an acclaimed success, the operation was not without its cost in human suffering, nor were the challenges few for medical personnel. The mission of Medical Logistics was to provide quality materiel support enabling military medics to care for the casualties and ease the suffering.

Operational Planning Factors

The size, location, and duration of casualty flow in a military operation is the main consideration for the medical logistician; by determining this, the scope of logistical support required (materiel category, quantity, source, transport, storage, maintenance, and distribution) can then be specified.

The categories of medical materiel requirements would be a function of the type of casualties to be expected. Given the equatorial environment of Panama, and that enemy forces were primarily equipped with small arms and explosives, the classification of materiel requirements would focus on the treatment of (1) tropical disease and illness, and (2) gunshot and shrapnel wounds. Medical problems inherent in crowded refugee camps could also be anticipated.

The quantity of materiel requirements would depend on casualty count expectations. Casualty count is a function of luck, the capacity of the enemy to resist, and the proximity of civilians to fields of fire. The enemy forces were reportedly composed of the Panamanian Defense Forces (PDF) which numbered approximately 15,000 personnel (one-third combat trained, the remainder in police or government administration functions) and an undetermined number of paramilitary civilian units called Dignity Battalions. The morale of the enemy was generally poor due to corruption, unpaid wages, substance abuse, and a negative public image. The operation would have the majority support of the Panamanian people, but their active assistance to US forces would be questionable. American and Panamanian civilians resided within expected combat zones, raising the possibility of significant collateral damage as well as the specter of terrorist retaliation.

The sources of initial and resupply medical inventories to treat operational casualties were primarily CONUS based. The United States was in a positive position because of

preestablished military bases throughout the canal and capital areas, including a well-developed airstrip at Howard AFB. Peacetime medical supply inventories were located at medical treatment facilities (MTFs) on each US base, although operational contingency stocks had not been prepositioned in Panama. The chief military MTF in Panama, Gorgas Army Hospital, had the largest inventory and was most responsible for intratheater medical logistics command and control. But Gorgas was located in a part of the capital that was likely to be under fire, and isolated during the conflict. Second echelon medical care for US casualties (the triage and initial treatment of combat injuries) was to be at the Joint Casualty Collection Point (JCCP). The JCCP consisted of deployed medical personnel in a portable hospital facility strategically located at the Howard flight line. Resupply from CONUS depots was to be by airlift into Howard AFB. Medical materiel would be distributed from Howard to US MTFs and deployed medical field battalions by truck or helicopter.

Combat terrain would be varied—remote jungle, provincial townships, and a sprawling, yet crowded urban capital. The bulk of enemy forces were positioned within a 100-kilometer radius of the capital/canal area, although combat units were scattered throughout the Panamanian interior. The establishment of medical supply distribution points in the interior was complicated by a wide range of possible battlefields, the ready availability of truck and helicopter transport, and the need to secure highways and landing zones. The operational scope of casualties—and thus that of medical logistics support requirements—was subject to the influence of known and unknown factors. Nevertheless, the overriding question became "How hard would the enemy fight?"

The Operation Itself

In the early hours of 20 December 1989, US soldiers, sailors, airmen, and marines attacked PDF installations located in the canal and capital areas.

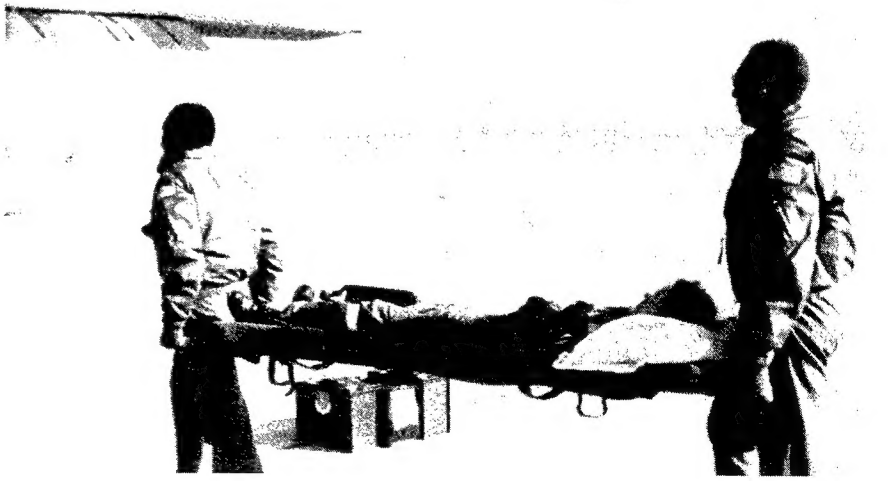
Airborne assault troops, light and mechanized infantry, and special operations were the primary units involved. Initial resistance was light to moderate, and by noon, most tactical objectives were achieved or within grasp. Over the next few days, US troops fanned out via highway and airdrop throughout the country and gradually secured isolated towns and provincial cities. Meeting little resistance from demoralized enemy forces, the country was effectively pacified within a week. The flow of casualties was heaviest the first day, but then gradually tapered off. Because of outstanding US execution and the enemy's weak response, the relatively low number of casualties in an operation of such wide scope was a positive development.

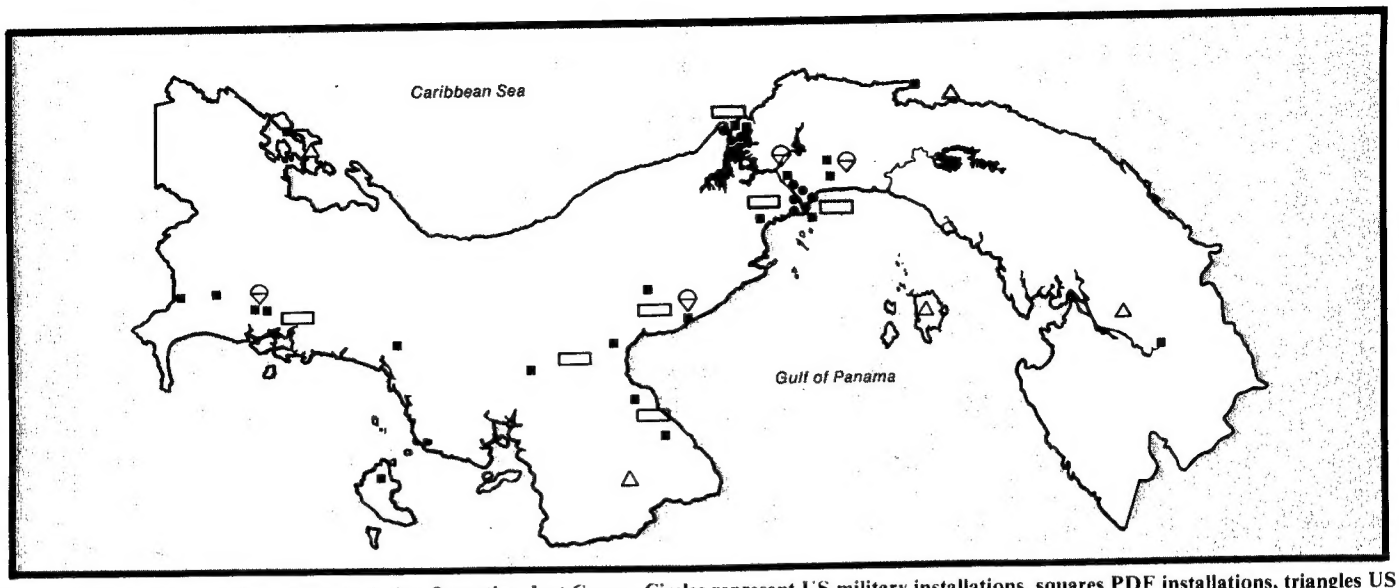
The Panamanian crisis had simmered for nearly two and a half years before the definitive action of Just Cause. Thus there was sufficient time to plan the operation in fine detail. Nevertheless the assault caught many by surprise, including some of those who would be responsible for managing operational components. For reasons related to OPSEC, the planning process did not filter down to those with "hands on" medical logistics expertise in Panama. Thus when H-Hour struck, those responsible for implementing the medical logistics plan had to become quickly acquainted with it and make the necessary adaptations to unraveling events. As the first day's casualties came pouring into the JCCP, the plan became less important than the common sense application of available personnel and materiel resources.

The JCCP was established at the Howard flight line to take advantage of the airstrip. This eased receiving helicopter casualties from the battlefield and then transporting them by C-130 and C-141 to military medical centers in San Antonio, Texas, for comprehensive care. Medical personnel from the Army's 44th Medical Brigade and the Air Force's 1st Aeromedical Evacuation Squadron (AES) (as supplemented by the USAF 24th Medical Group) triaged and stabilized casualties at the JCCP's tent site facility.

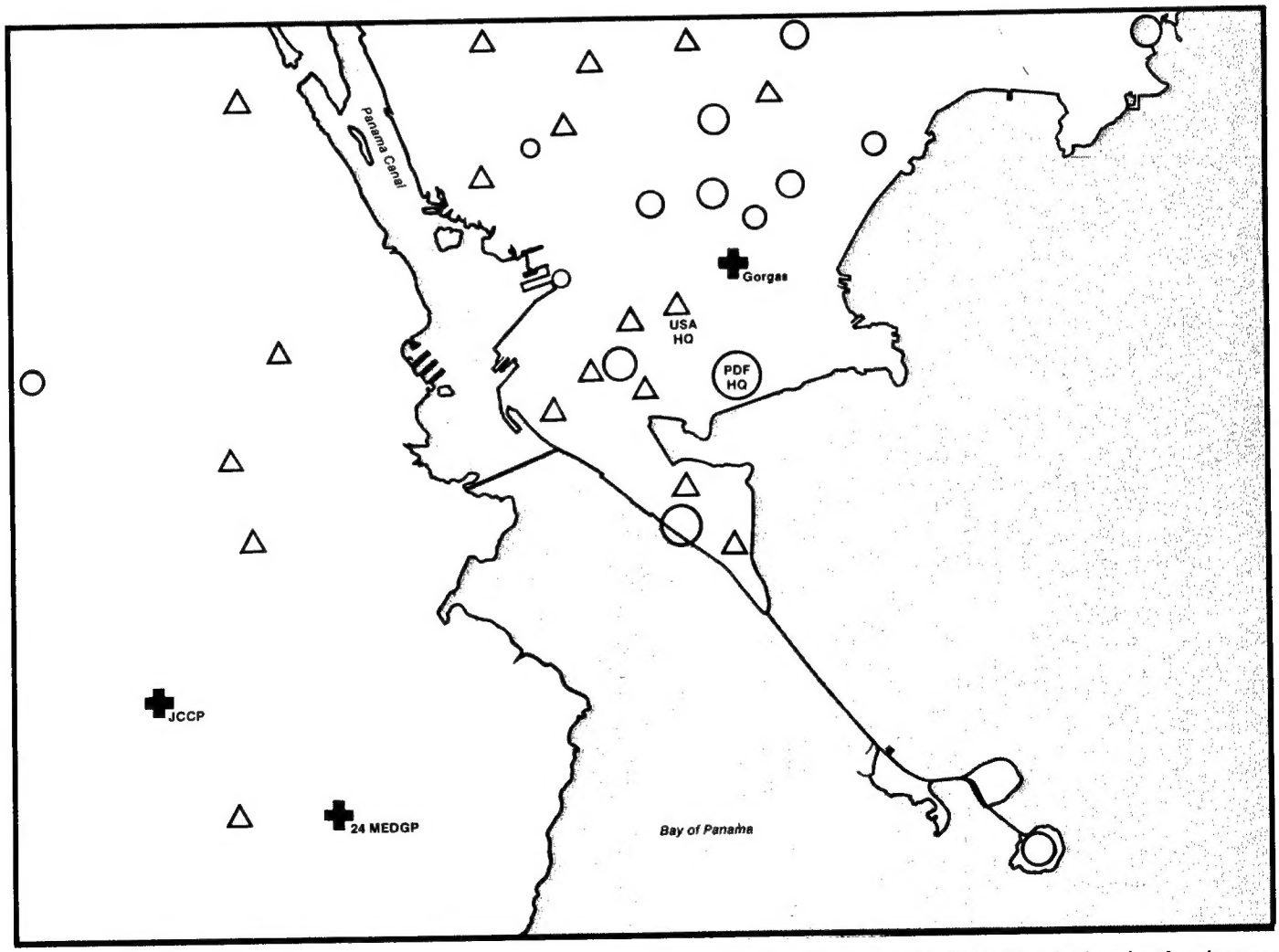
The plan called for JCCP deploying medical personnel to bring adequate supply and equipment stocks to see them through the first few days, after which US MTFs in Panama would resupply them using the CONUS pipeline. For whatever reasons, critical but routine supplies of litters, blood expansion fluids, sterile gauze, etc., ran short by the first evening. Restocking procedure called for procurement action through the Emergency Supply Operations Center (ESOC) at the Defense Personnel Support Center (DPSC) in Philadelphia, Pennsylvania. The ESOC to Panama priority pipeline was 24 to 48 hours. Aeromedical evacuation missions were departing San Antonio towards Howard AFB for casualty turnaround, and the idea was struck to requisition supply shortages from San Antonio MTFs, put them aboard incoming aerovac missions, and deliver them to the JCCP upon touchdown in Panama. Supply requests were transmitted by AUTOVON and FAX machine to USAF Wilford Hall Medical Center, whose medical logistics personnel pulled, packed, palletized, and loaded the materiel on incoming aircraft. The needed supplies were at the JCCP within 24 hours after receipt of requisition.

The heavy load of casualties during the operation's opening stages necessitated additional manpower at the JCCP to carry litters, drive ambulances, assist in the treatment of injuries, comfort the wounded, erect facilities, and command and control activities. Personnel at the 24th Medical Group who were not absolutely essential to the





Map 1 depicts the broad flow of events during Operation Just Cause. Circles represent US military installations, squares PDF installations, triangles US special forces operations, rectangles US infantry deployments, and ovals US airborne actions. Though the bulk of the action was centered in the vicinity of the capital and canal, the difficult tropical terrain and scattered enemy forces complicated the scope of operation.



Map 2 represents a portion of Panama City where much of the action occurred. Crosses signify military medical facilities, triangles American housing areas, and circles battles or fire fights (size indicative of scope). The map illustrates the proximity of American civilians to combat zones, the isolation of Gorgas Army Hospital, and the distance complications between urban battlefields and the JCCP. Note the battle at PDF HQ (the Commandancia), and how close the opposing headquarters were located.

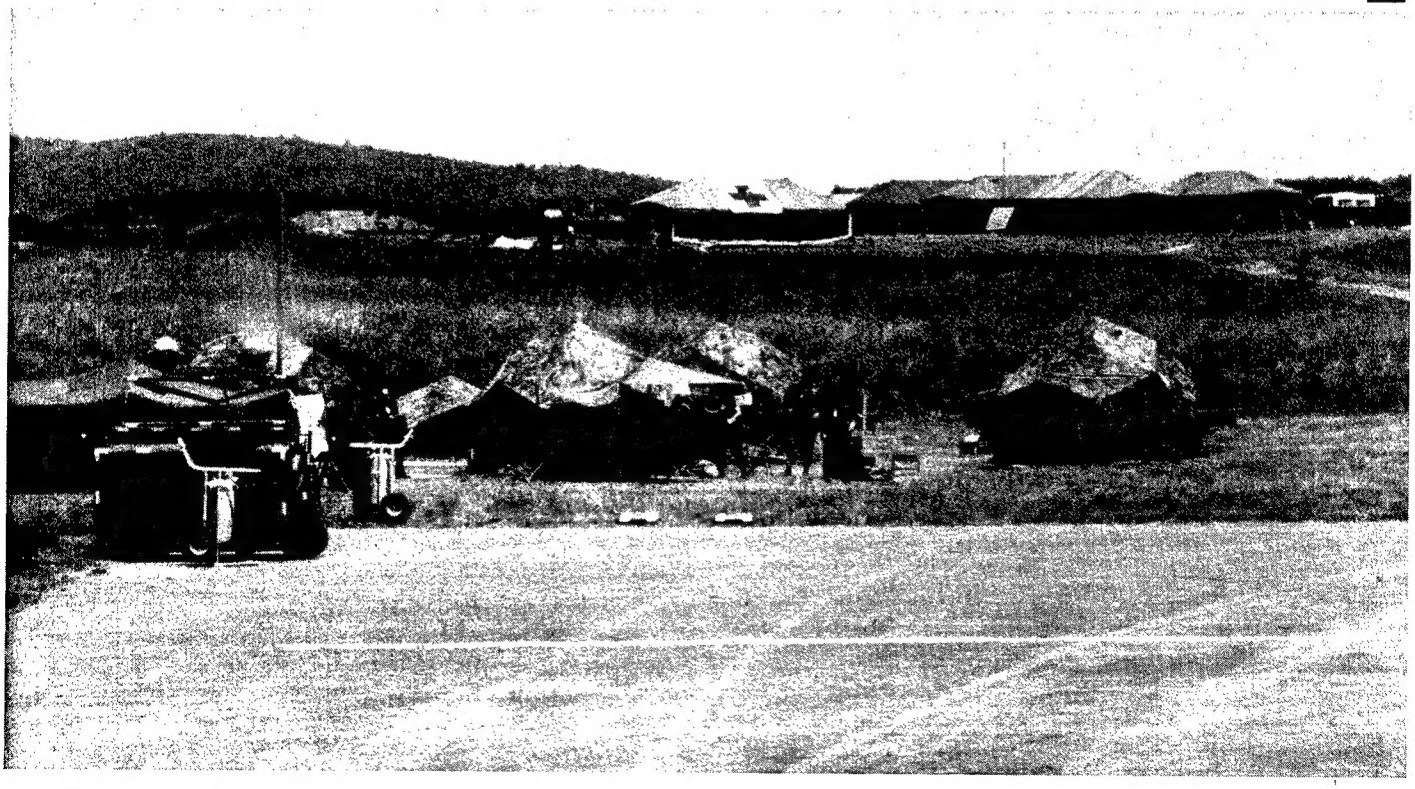
operation of the clinic were sent to assist at the JCCP, including more than half of the unit's medical logistics staff. Automated supply and equipment inventory transactions were available through several computer systems including the USAF's Medical Logistics (MEDLOG) system. However, these sensitive systems require a continuously reliable power source to operate, or the risk of systems failures and resultant time-consuming data recoveries is great. Electrical power in the opening days of Just Cause was not reliable enough to activate our MEDLOG because it was not equipped with an uninterruptible power supply device. Medical logistics personnel were forced to rely on manual accounting procedures. The clinic facility went into operation 24 hours a day to provide routine and emergency medical care to all comers, and the medical logistics section supported a wide variety of triservice requirements without the obstacle of fund sites. The responsibility to feed, house, and transport clinic personnel fell upon the medical logistics staff. They provided the rations, cots, linen, transportation, and facility support to enable clinic personnel to man their own duty stations continuously. In short, the Chief, Medical Logistics Management, found himself short staffed, busy 24 hours a day, manually managing his inventory, and picking up additional responsibilities.

As the operation wound down, the medical logistics focus shifted from combat casualties towards the provision of humanitarian relief to the Panamanian people. The Southern Command Surgeon General (SOUTHCOM/SG), in conjunction with the Panamanian Health Ministry, identified and initiated procurement of over $7,000,000 in medical materiel aid to assist the new government. Their joint efforts provided desperately needed healthcare to a multitude of wounded and displaced. The medical logistics staff of the 24th Medical Group lent modest assistance to this large undertaking by tracking air shipment of bulk supplies from CONUS depots to Panamanian airstrips, and by delivering supplies to the capital's hospitals, clinics, refugee camps, and jails.

As another initiative towards humanitarian assistance in the wake of Operation Just Cause, the SOUTHCOM/SG office rekindled Medical Readiness and Training Exercises (MEDRETE) in Panama. The MEDRETE concept involves sending a professional medical team of US military and local nationals into remote sections of the country to provide indigenous populations with medical, dental, and veterinarian care. The provision to the MEDRETE of medical and nonmedical supplies and equipment, transportation, communications, sustenance, and billeting, as well as the command and control of the medical team, is the responsibility of the Medical Service Officer in charge. Though an Army tasking in Panama, the Air Force and Navy are increasingly becoming involved in these missions. In fact, the medical logistics staff at the 24th Medical Group conducted its first MEDRETE in July.

Conclusions

Sound planning, successful execution, and "good luck" favored United States military medicine in Operation Just Cause. From the medical logistics perspective, a significant increase in casualties due to more intense hostilities or an unforeseen mass casualty accident may well have overtaxed the available supply of medical materiel. Good OPSEC was a key to the success of this operation, but methods should be found to ensure that mission relevant expertise is built into the planning process without compromising OPSEC. Operational managers must be prepared to fall back on alternative procedures and do more with less resources. Each component in the logistics chain should be carefully considered, along with associated options, should primary assumptions become inviable. Finally, there are few things more satisfying than participation in a successful operation with the positive repercussions of a "Just Cause."



Waste Management in Air Force Medical Facilities

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Until recently, the disposal of waste from a medical treatment facility did not pose significant problems. Laboratory cultures were autoclaved and pathology specimens, organs, and other tissues were incinerated in a pathological incinerator. In the civilian sector, unsafe and often unethical disposal practices concerning waste from medical facilities have placed hospitals and clinics under close scrutiny by the general public. Air Force medical facilities are no exception. The purpose of this article is to explain the dilemma facing medical logistics managers and outline the steps being taken to protect patients, staff, visitors, and the environment from the risk of exposure and the appearance of exposure to potentially infectious, hazardous, and radioactive waste.

Classifications of Waste

To begin, several definitions should be clear to the reader. Waste from medical facilities can be broken down into several classifications: medical, hazardous, general, and radioactive.

Medical

Medical waste, according to Title 40 of the Code of Federal Regulations Part 259, is any solid waste which is generated in the diagnosis, treatment, or immunization of human beings or animals, in research, or in the production or testing of biologicals. The term does not include any hazardous waste or household waste. A category of medical waste, infectious medical waste, is a waste capable of producing an infectious disease considering (1) presence of a pathogen in sufficient quantities to induce an infectious disease, (2) favorable environment for the pathogen to survive, (3) a mode for the pathogen to gain entry into the host, and (4) resistance of the host to the disease. Included in the general category of medical waste are cultures and stocks of infectious agents, pathological waste, human blood and other body fluids containing visible blood, used sharps, contaminated animal carcasses, infectious isolation waste, and unused sharps.

Hazardous

For waste to be considered a hazardous waste, it must meet the definition of a solid waste (a solid, liquid, semisolid, or contained gaseous state that is no longer fit for its original intended use and must be disposed of, or treated prior to being used again) and is listed by chemical name in Title 40 of the Code of Federal Regulations Part 261 or has one of the following characteristics: ignitability, toxicity, corrosivity, or reactivity.

General

Waste originating from food service areas, administrative offices, and discarded packing materials is regarded as general waste and is not subject to any specific handling and disposal restrictions.

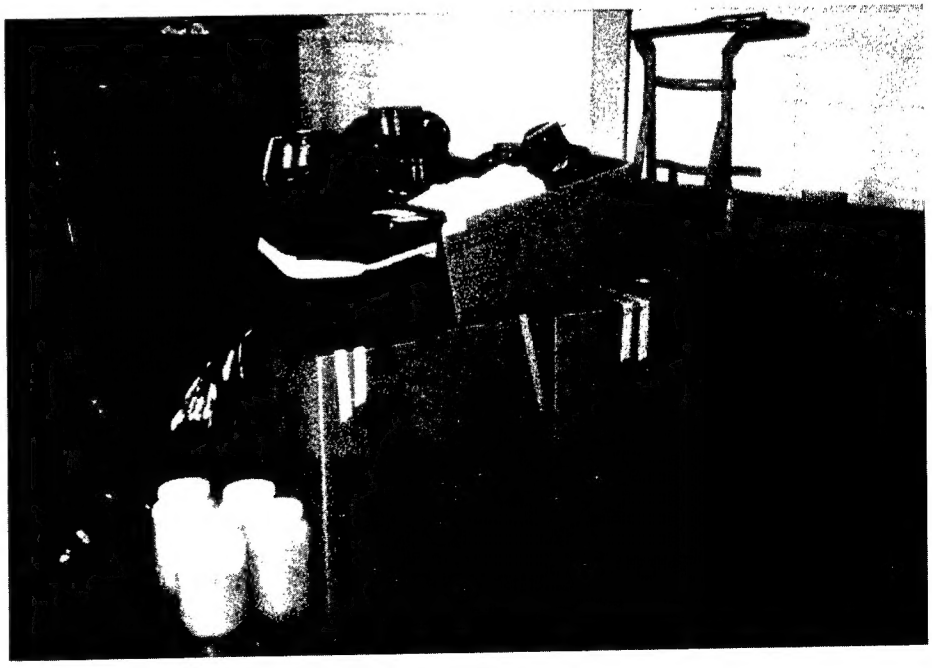
Radioactive

Finally radioactive waste presents unique problems for disposal because of its low-level radioactive nature. Not only does some of the radioactive waste have to be treated as hazardous waste, but it also is a regulated waste under the Nuclear Regulatory Commission (NRC) guidelines and must be disposed of accordingly.

Management of Waste

Medical logistics managers play a key role in the comprehensive management of waste in order to reduce hazards to personnel, reduce contamination of the environment, and minimize the liability of handling the waste. Complete and comprehensive management of the waste stream, however, crosses all departmental boundaries and is therefore an organizational responsibility that cannot be the sole responsibility of one individual or department.

Due to the impact mismanagement of waste can have on personnel safety and the environment, most federal environmental statutes require facilities of the United States Government to comply with state and local regulations as well as federal regulations. Additionally, the Joint Commission on Accreditation of Healthcare Organizations requires a hazardous materials and waste program operated under applicable laws and regulations. For these reasons, the Air Force Surgeon General directed all Air Force medical treatment facility commanders to comply with federal, state, and local laws



Typical packaging of medical waste prior to incineration.

at each base location. This action places responsibility on the medical logistics manager to ensure local management programs for waste meet all applicable laws.

The management of hazardous waste is outlined in Title 40 of the Code of Federal Regulations. Hazardous waste is defined by the Resource Conservation Recovery Act in Title 40 of the Code of Federal Regulations Part 261, or can be any other substance that meets criteria as previously defined. Hazardous waste is turned in on supply documents to the Defense Reutilization Marketing Office (DRMO) at each operating location or nearest base DRMO. The turn-in must be coordinated through the Bioenvironmental Engineering Services (BES) Officer and the Base Environmental Coordinator prior to any movement of the hazardous waste. The most common hospital hazardous waste includes antineoplastic drugs, ethylene oxide, formaldehyde, chlorine, and laboratory chemicals. The BES Officer is consulted by the logistics manager for technical guidance in identifying hazardous waste and assistance in developing an overall program of waste management that is in compliance with applicable federal, state, and local regulations.

In addition to the turn-in of hazardous waste to the DRMO, the logistics manager must also be concerned with hazardous waste minimization. Since the Director of Medical Logistics (DML) procures virtually all the supplies and equipment used in a medical treatment facility, that office is the logical point at which to begin the practice of reducing the volume or toxicity of the hazardous materials ordered which may become hazardous waste through use. Several hazardous chemicals routinely used now have nonhazardous substitutes available. Some hazardous materials can actually be recycled through base programs.

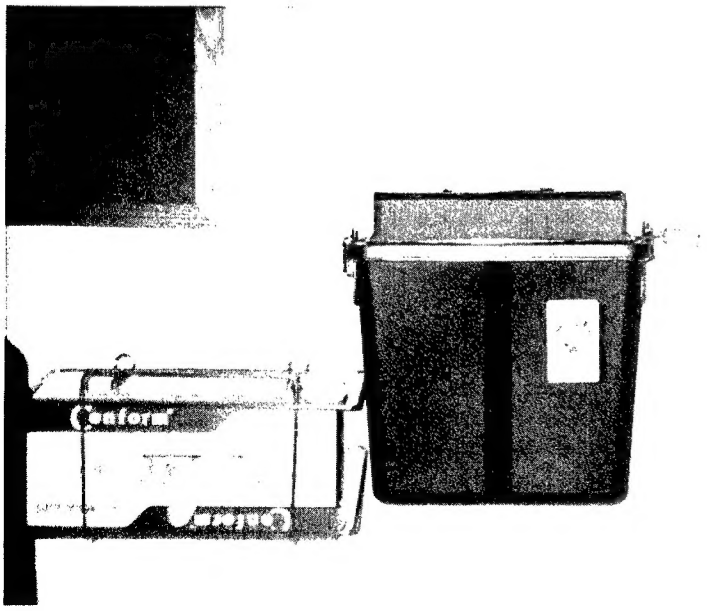
Next, the management of infectious waste is a responsibility of the facility manager, who comes under the supervision of the DML. The Environmental Protection Agency (EPA), which is responsible for regulating the hazardous waste on a national level, does not have specific regulations governing the management of infectious waste at this time. There is, however, a Congressional mandated test program known as the Medical Waste Tracking Act of 1988 (MWTA). The MWTA follows EPA guidelines and regulates certain categories of medical waste from point of origin to point of destruction. The MWTA currently affects Air Force medical facilities located in New York and New Jersey. At the end of the two-year test program, Congress will decide whether or not to make the MWTA a federal program.

The lack of federal guidance governing infectious waste has necessitated many individual states to pass their own infectious waste management regulations. For this reason, the first step in managing infectious waste at the medical facility is to determine, with the assistance of legal counsel and state EPA representatives if necessary, which regulations may apply. Once facility managers have made this determination, they meet with the Infection Control Committee to formulate a facility policy that identifies and defines categories of infectious waste for that facility. The facility must then decide if the infectious waste will be treated on-site or transported to a licensed infectious waste disposal facility by a licensed waste hauler.

Treatment at an off-site facility is becoming increasingly more popular with many medical facilities. In today's climate of Defense Department budget cuts, this represents a solution to the infectious waste problem with little or no initial capital investment. On the other hand, off-site destruction requires strict packaging and transport precautions to ensure containment in the event of an accident. Treatment on-site minimizes packaging and transport problems and allows the facility to control the process through the treatment phase. However, on-site treatment, as with any option, has its drawbacks. If the waste is incinerated, autoclaved, chemically disinfected, shredded, or treated by another means on-site, the logistics managers must ensure compliance with all applicable laws and regulations for meeting air, waste, and landfill regulations in their particular location.

In Air Force medical treatment facilities, a variety of waste is generated every day. This waste is regulated by different agencies in a constantly growing library of regulations. What this means is a monumental challenge to the logistics manager. The medical treatment facility leadership must develop an overall plan to deal with waste in a safe, responsible, and economical manner that minimizes the risk to personnel and the environment. The logistics manager in many situations must become the leader and must often make decisions without a lot of concrete guidance.

The management of waste remains an organizational responsibility, and the medical logistics manager continues to play a key role in a comprehensive waste management program. Assistance is available from the base Environmental Coordinator and the base Bioenvironmental Engineer. Through cooperation of all personnel involved in the program, mechanisms of compliance can be put into place which will substantially reduce the risks associated with waste management.



Sharps containers must be secured to the wall.

Technology Explosion in Healthcare

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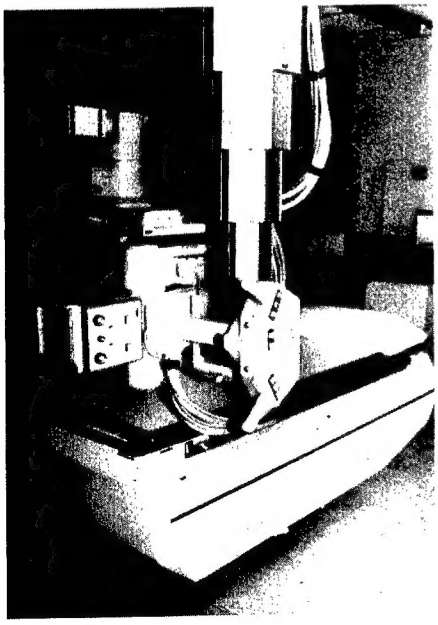
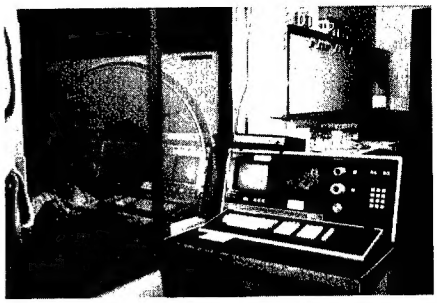
Healthcare has become increasingly dependent upon technology in recent years. This dependence has manifested itself in technologies for diagnosis such as imaging technologies like positron emission tomography (PET), magnetic resonance imaging (MRI), computerized tomography (CT), and ultrasound scanners (US). In addition, there are now palliative technologies such as transcutaneous electrical nerve stimulators (TENS) for pain management, electrical bone growth stimulators, and cardiac pacemakers for controlling irregular heartbeats. Further, advanced technologies are being used in rehabilitative treatment such as the use of dye, argon, krypton, neodymium-yttrium-aluminum-garnet (Nd:YAG), and carbon dioxide lasers (light amplification by stimulated emission of radiation) as surgical instruments; electronic passive motion isokinetic exercisers for physical therapy of arms and legs; and extracorporeal shock wave lithotriptors (ESWL) for non-surgical fragmenting and removal of kidney and urethral stones. These technologies primarily reflect developments with exclusively medical applications. However, other technologies which blossomed in other markets have been adapted to healthcare.



Radiography/Fluoroscopy X-Ray Unit
(US Air Force Photo)

Information processing equipment has far-reaching technological impacts on healthcare. It is virtually impossible to acquire even the most rudimentary piece of medical equipment which does not have a microcircuit chip controlling some function. One of the least complex and oldest electrical technologies in healthcare is the suction pump. Even this very simple unit now has a microcircuit chip controlling the electric motor which develops the suction. There are few pieces of clinical laboratory equipment (blood gas analyzers, chemistry analyzers, microbiology systems, cell counters, radioimmunoassay systems) whose processing of samples is not computer controlled. Additionally, advances in electronic capability such as CD-ROM optical memory disks, optical streaming tape, high capacity magnetic media (hard and floppy disks and tape), fiber optic cable, and high resolution cathode ray tubes (CRT) permit computer controlled digitization, electronic manipulation, transmission, display, and storage of medical images. This technology is called digital imaging network/picture archiving and communications systems (DIN/PACS). Hospital information systems have also reached high levels of sophistication performing many of the more routine functions, thus freeing healthcare providers to spend increasing quality time with patients. Obviously, technology assessment, acquisition, and management have become more complex in tandem with the advances in the technology being acquired.

Today's Medical Logistics Officers must have a macro view of the healthcare world. The purchase of a piece of equipment is not merely acquisition of technology. With this acquisition comes an operational tail including installation, facility modification, utility requirements, preventive maintenance, breakdown repair, spare parts, disposables, training, storage, manpower requirements, requirements for additional specialties, and eventual replacement when new technology evolves or old technology dissolves. In addition to these technical considerations, there are numerous clinical considerations to which they must be sensitive.



Computerized Tomography (CT) Scanner
(US Air Force Photo)

The clinical considerations are best viewed as questions. Will practice patterns among other healthcare providers change thus creating additional requirements for other pieces of equipment with their operational tails? Will facility patient flows change? Will waiting rooms need to be larger? Will patients who have been receiving care in the private sector now receive care in our military facility? Will their return to the military healthcare system create additional logistics requirements for supplies and equipment? Will additional healthcare providers be assigned to the facility? What are their supply and equipment requirements? What are the utility impacts on such systems as heating ventilation and air conditioning, area illumination, uninterruptible power supplies, and power conditioning? The wide ranging impacts of technology acquisition call for a special person to manage it.

Today's medical logistician must be part clinical engineer, computer systems specialist, healthcare provider, health technician, administrative specialist, healthcare administrator, diplomat, politician, and bureaucrat with the skill of Nostradamus in predicting the future. Obviously no such person exists. To the greatest extent possible, then, we must develop avenues to assist logisticians in effectively managing this complex technology environment.

One program to assist them is the Basis-of-Issue (B-O-I) Equipment Document project. The USAF Surgeon General's clinical consultant group selects and puts into priority sequence clinical specialties which are highly technology dependent. Then, through the use of clinical consultants for the specialty, B-O-I Equipment Documents are developed. They contain a list of suggested supply and equipment items necessary to establish and maintain high quality levels of healthcare in providing a particular specialty. In addition, they give threshold criteria for minimum

quantities of each item. Unlike a Table of Allowance, these are living documents which change as frequently as the technology changes, be that yearly, monthly, weekly, or daily. As a minimum they are updated annually. Items listed on the B-O-I Equipment Document are authorized without additional justification so long as the threshold criteria are met. Through this process, medical logisticians are relieved from doing anything more than signing paperwork and commencing acquisition activity. These B-O-I documents are prepared by the Clinical Consultant's Division of the USAF Surgeon General's Office in coordination with the Medical Logistics Division in the Directorate of Healthcare Support. There are other programs where the equipment is acquired centrally and the authorization process remains decentralized.

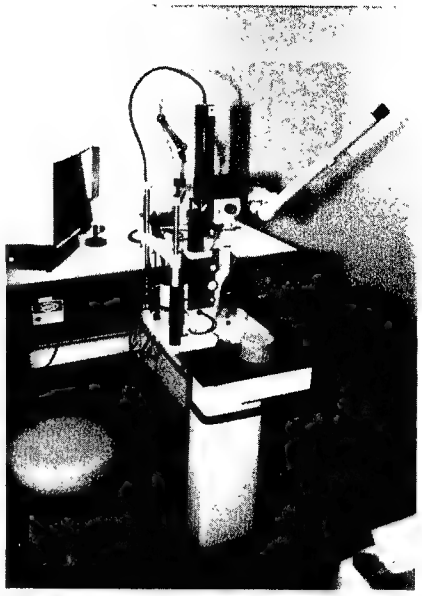
These programs to assist logisticians include centralized acquisition of radiography/fluoroscopy units, CT scanners, MRIs, ESWLs, 12-lead and portable battery powered defibrillator/ monitors, pulse oximeters, fetal heart monitors, physiological monitors, refrigerated laboratory centrifuges, biological refrigerators, electrosurgical apparatus, blood cell washers, dental operating systems, mammography units, blood gas analyzers, and DIN/PACS. Acquisition agents include the Defense Personnel Support Center (DPSC), Philadelphia, Pennsylvania; the medical, textile and subsistence acquisition branch of the Defense Logistics Agency; and the Army Corps of Engineers, Huntsville Division, Huntsville, Alabama. While the complexities of the authorization process are not eliminated, the more complex knowledge required to acquire these sophisticated technologies is made available through the central acquisition agent's engineers and logisticians.

Magnetic Resonance Imaging (MRI) Scanner
(Photo Courtesy GE Medical Systems)

Information processing systems are, in most cases, also acquired centrally for the same reasons. The Defense Medical Systems Support Center (DMSSC) is the agent for acquisition of these technologies. DMSSC is a Department of Defense wide agent. An entire article could be written on this single area of military healthcare technology. Needless to say, the best Systems people from the three services are jointly working to provide the most useful healthcare information systems available. Their expertise again saves the medical logistician from having to develop extensive knowledge in another technologically complex area. However, logisticians still have an obligation to maintain their technology knowledge base.

The successful medical logistician reads the *Health Devices* journal, a publication of ECRI, a not-for-profit, independent, testing laboratory in Plymouth Meeting, Pennsylvania. This journal is the "*Consumer Reports*" of the medical technology industry. Each issue is dedicated to an in-depth analysis of a single technology. In addition, there are short articles on other technologies, incidents, hazards, and items of general interest concerning healthcare. With a subscription to *Health Devices*, subscribers also receive weekly *Health Devices Alerts* and bi-weekly *Health Devices Abstracts*. Other sources of information include ECRI's *Product Comparison System*. This document set provides a comprehensive review of the features of a particular technology and how it works in addition to details of all the features of each vendor's equipment in that technology line. There are administrative publications which also assist medical logisticians in keeping their edge.

Healthcare Executive published by the American College of Healthcare Executives, Chicago, Illinois, is another valuable source of information on technology. There are other journals focused on narrow spectrums of technology such as *Administrative Radiology*, published by Glendale Publishing Corporation, Glendale, California, and various publications from the Office of Technology Assessment of the United States Congress published by the US Printing Office, Washington, DC. In addition, there are numerous other publications which address healthcare technology issues which any logistician can find in the local medical library. A level of sophistication in understanding technology is essential to any healthcare administrator.



Ophthalmological Dye Type Surgical LASER
(US Air Force Photo)

As technology continues to grow in sophistication and complexity, the demands on Medical Logistics to respond to the technology needs identified by healthcare providers will grow. With this growth comes expectations from healthcare providers that medical logisticians can make both informed and economical acquisitions. These expectations will result in the knowledgeable logistician being sought out for consultation and the ill informed being avoided. Professional logisticians will want to find themselves in the former rather than the latter group.

Specialized Medical Contracting Activity (SMCA)

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In October 1986, the Air Force Surgeon General tasked Headquarters, Air Force Office of Medical Support to develop a program that would enhance medical contracting and provide for continuity with service contracting for the Air Force Medical Service. The Surgeon General was specifically interested in substantially improving his responsiveness to current and anticipated medical contracting requirements.

Prior to the establishment of the SMCA, medical contracting was performed by four civilians assigned to the logistics division of the Air Force Office of Medical Support. Their work was limited to contractual technical policy development and acquisition planning. The Surgeon General provided additional personnel to develop a new medical contracting system that would expand contracting services offered to the field.

As the new medical contracting office began taking shape, it became apparent that the most significant improvement would be to establish a contracting activity now designated as the SMCA under the control of the Surgeon General. This would allow the SMCA to direct communication with central as well as base level contracting office buyers beginning with the solicitation and award phases of the contracting process. It would also retain Surgeon General control over the technical policy development and acquisition planning.

The mission of the SMCA is:

> To provide responsive support and advice to the Air Force Medical Service in all matters related to contracting. The SMCA is responsible for developing, soliciting and awarding medical services contracts that are required by multiple locations with similar needs or services contracts that lend themselves to be centrally procured. Guidance will be provided to medical treatment facility personnel on medical service contracting and provide a supportive link between those individuals and base level contracting organizations. All contracting endeavors will have the patient's best interest in mind.

Ten goals were established to ensure mission accomplishment (Figure 1). Most of the goals, such as handling centralized buys, advising, coordinating, and providing support to the field, are ongoing; and additional goals will be set, as needed.

To Contract, or Not to Contract?

Air Force medical treatment facility commanders and administrators generally prefer to use military professionals to provide care to their patients. Because this was not always possible, alternatives were developed over the years to ensure adequate numbers of healthcare professionals and services are available. CHAMPUS, Supplemental Care, Cooperative Care, and the Partnership Program are among the most frequently used alternatives.

Contracting for medical services as an alternative has existed for some time, but only in the past two years has it received much renewed emphasis. The SMCA does not advocate that contracting is always the best solution, because many times it is relatively expensive. But at the same time, contracting for medical professional services must be considered under the following circumstances:

(1) When military staff is unavailable, civilians can be hired to provide services under contract, for long-term needs or simply while waiting for military personnel to be assigned. Additionally, contracted services may be provided either inside or outside the medical facility.

(2) Contract physicians, dentists, paraprofessionals, and others can be provided for locations or duties that have been difficult to staff.

(3) Blanket purchase agreements (BPA) and purchase orders (PO) may be used to provide services from physicians, dentists, and others when augmentation of the medical treatment facility's staff is required. Normally this occurs when less than a full-time equivalent is needed to provide the required care.

(4) Contracting may actually be less expensive than other alternatives because prices vary from one region to another, and they can sometimes be negotiated. Contracting should be considered with other alternatives to healthcare delivery, and not solely as a last resort.

SMCA'S GOALS

1. HANDLE SURGEON GENERAL CENTRALIZED "BUYS."
2. ADVISE MEDICAL TREATMENT FACILITIES ON BOTH LOCAL AND CENTRALIZED CONTRACTING MATTERS.
3. COORDINATE INDIVIDUAL MEDICAL TREATMENT FACILITY MEDICAL CONTRACTING REQUIREMENTS WITH LOCAL BASE CONTRACTING OFFICES WHEN PROBLEMS EXIST.
4. PROMOTE MEDICAL CONTRACTING TRAINING.
5. WORK WITH HQ USAF/SGP AND HQ AFMPC ON STAFFING ISSUES RELATED TO THE AIR FORCE MEDICAL SERVICE.
6. DEVELOP COMPREHENSIVE PROFESSIONAL SERVICES WORK STATEMENTS.
7. ENSURE OPTIMUM SERVICES FOR DOLLARS SPENT.
8. PROVIDE RESPONSIVE CONTRACTING SUPPORT TO THE FIELD.
9. BE INNOVATIVE AND PROACTIVE.
10. LISTEN AND REACT TO THE NEEDS OF OUR MEDICAL TREATMENT FACILITY COMMANDERS.

Figure 1.

Some 84 professional services Performance Work Statements (PWS) have been developed by the Contracting Policy and Operations Branch and are currently available (Figure 2). Requests for the documents are normally made through the respective major command surgeon general offices, and in some cases medical facilities may request documents directly from the branch.

Central Buys

The SMCA has been involved in a number of central or collective buys since its inception. The more significant projects are:

Dental Services Contracts. Approximately two years ago, the Air Force Medical Service transferred 100 dental positions to the Nurse Corps to satisfy readiness requirements. The need for the dentists still existed, and a centrally produced contract was used to fill the vacancies. The requirement was for 98 contract dentists at 69 sites. All but five sites have been filled.

Primary Care For the Uniformed Services (PRIMUS). Centrally procured PRIMUS clinics were opened in late Fiscal Year 1988 at Davis-Monthan AFB, Arizona; March AFB, California; and Offutt AFB, Nebraska. Contracts for PRIMUS clinics at MacDill AFB, Florida, and Mather AFB, California, were awarded 2 Feb 90.

Radiology Requirements Contract. This type of contract is designed to provide radiologist staffing assistance to medical treatment facilities needing the services of a radiologist for a period between 1 week and 26 weeks. This contract was awarded 4 Apr 90, and copies of the contract with instructions were provided to all major command surgeons. Indefinite Quantity Contracts are being considered for other types of specialities.

Hospital Aseptic Management System (HAMS). Fifty-seven Air Force hospitals have HAMS contracts as of Fiscal Year 1989. (HAMS contracts are for cleaning hospitals which have surgical capabilities.) The SMCA plans to expand such contracts to European hospitals beginning in Fiscal Year 1990.

Real Property Maintenance. David Grant USAF Medical Center located at Travis AFB, California, was awarded the first total Operations and Maintenance Contract for the Medical Service. This contract provides for housekeeping services and all plant management activities. The SMCA hopes this type of contract will become a model for other hospitals.

Catchment Area Management. The SMCA participated in several meetings in preparation for the catchment area management demonstrations at Bergstrom AFB, Texas, and Luke AFB, Arizona. The SMCA staff members anticipate increased contracting activities during this test period and are available to work with Tactical Air Command to satisfy its contracting requirements.

The College of American Pathology Surveys: Interagency Institute; HIV Testing; Family Advocacy Programs; Civilian Drug Testing; and The American Hospital Association are a few of the other areas where contacts have been awarded by the SMCA.

The Contracting Branch of the Medical Logistics Division has made positive strides in improving Air Force contracting posture since the establishment of the SMCA. The SMCA remains in close contact with field

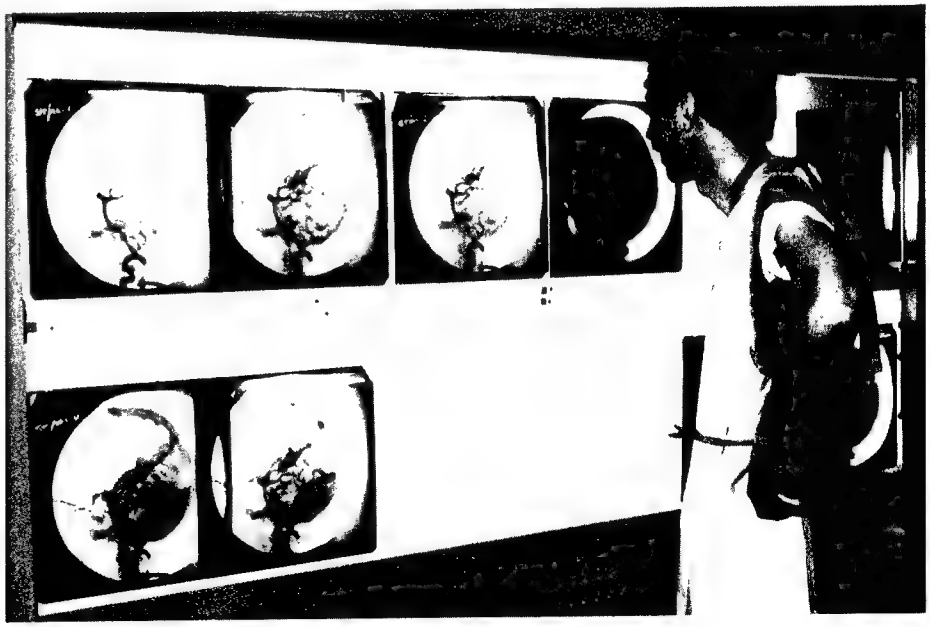
PERFORMANCE WORK STATEMENT LISTING

Allergy (A)
Ambulance, Air (A)
Ambulance Attendant (B)
Ambulance Service
Anesthesiology (A)
Audiology (B)
Blood Bank Technologist (B)
Cardiac Perfusion (C)
Cardiology (C)
Cardiopulmonary Technician
CT Scan Mobile
Cytotechnology (B)
Dentist, General
Dental Hygienists (B)
Dermatology (A)
Emergency Room (C)
Endocrinology (C)
ENT (A)
ENT w/tech/nurse (A)
Family Advocacy
Gastroenterology (A)
Health Promotion Coordinator
Health Physics w/tech
Lithotrypsy (A)
Mammography (C)
Medical Physicist Consulting (A)
Medical Laboratory Technician (B)
Medical Transcription (B)
Medical Waste
Medicine, General
Medicine, Internal (C)
Medicine, Internal Resident
Medicine, Pulmonary (A)
MRI Rhuematology (A)
MRI Mobile (B)
MRI Technician (C)
Neurology (C)
Neurosurgery (A)
Nuclear Medicine (A)
Nurse Anesthetist (CRNA) (C)
Nurse, Medical Licensed Practical (C)
(AFR 400-28 Format)
Nurse Practitioner, OB-Gyn (C)
Nurse, Public Health (B)
Nurse, Surgical Licensed Practical (C)
Nursing (B)
OB-Gyn (C)
Occupational Medicine (A)
Occupational Therapy (B)
Occupational Therapy (DODDS) (A)
Oncology, Medical (A)
Operating Room Tech (A)
Ophthalmology (A)
Optometry (A)
Orthopedics (C)
Pathology & Pathology QA (A)
Pediatrics (C)
Pediatric Hematology/Oncology (A)
Pediatric Neurology (A)
Pediatric Neuro-psychology (B)
Pharmacist
Pharmacy Technician (B)
Phlebotomy (B)
Physical Therapy (B)
Physical Therapy (DODDS) (A)
Physician Assistant (B)
Podiatry (A)
Psychology (A)
Psychiatry (A)
Psychiatry, Child
Psychiatry, Child Drug & Alcohol Abuse(A)
Psychology, Clinical (A)
Radiation Therapy Tech (A)
Radiation Therapy Physics Sup w/tech (A)
Radiation Therapy Physics Sup w/o tech (A)
Radiology (C)
Radiology Oncology (C)
Radiology Support Technician
Remote Site Technician (A)
Social Worker (B)
Surgery Resident
Surgery, General
Sonography (C)
Urology (A)
Waste Disposal, Medical

LEGEND:
(A) Nonpersonal Svs PWS immediately available
(B) Personal Svs PWS immediately available
(C) Both immediately available
(DODDS) Department of Defense Dependent School

Figure 2.

contracting activities and initiatives, and has worked on new contracting requirements that will benefit patients and provide for additional access to medical care. The incorporation of the SMCA and charter is responsible for streamlining medical contracting procedures and has been at the forefront in developing training programs and marketing strategies. The ultimate goal is to provide services that will benefit patients and, at the same time, ensure that the Air Force Surgeon General receives optimum services for dollars spent.



Medical Logistics in Vietnam

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Introduction

An outstanding part of the logistics effort in the Vietnam War was the medical service. The excellent medical care in Vietnam was due to many factors, and medical logistics was one of the most important elements contributing to the success.

Hospital mortality rates during the Vietnam War are documented as 1% or 2.6%, depending on who is quoted. Army statistics show that between January 1965 and December 1970, 133,447 wounded were admitted to medical treatment facilities in Vietnam; 97,659 of these were admitted to hospitals. Major General Spurgeon Neel, USA, documents the Army hospital mortality rate for this period as 2.6%. (15:51;16:8) Most other references state the mortality rate as 1%. (2:277;9:224;18:17;22:64) This compares with the generally agreed upon figures of 4.5% in World War II and 2.5% in Korea. Neel explains the primary decrease in the Vietnam War from the Korean War was a result of rapid helicopter evacuation, which brought mortally wounded patients into the hospital who, in the Korean War, would have died en route due to slower means of evacuation. (15:51) Only 15% of the wounded were evacuated by helicopter in the Korean War. (2:277;18:17;22:64) It is estimated that more than 90% of all wounded in Vietnam were evacuated from combat areas by helicopter. (12;18:17;22:64) If the patients who died within 24 hours were assumed to be in this class, the hospital mortality rate would be closer to 1%. (15:51) No matter what figures we use, it is obvious the medical services in Vietnam were better than those of previous wars. A wounded military person's chance of recovery in the Vietnam War was 2.2 times better than that of the Korean War. The chances were 4.5 times better than in World War II and 8.5 times better than in World War I. (12) A better index of the effectiveness of medical treatment was the ratio of deaths to deaths plus surviving wounded ("deaths as a percent of hits"). In World War II, it was 29.3%; in Korea it was 26.3%; and in Vietnam it was 19.0%. The ratio of killed in action (KIA) to wounded in action (WIA) is as follows: World War II, 1:3.1; Korea, 1:4.1; Vietnam, 1:5.6. (15:51;16:8)

This paper will discuss several aspects of medical care in the Vietnam War. Among the areas that will be included are the types of injuries and diseases found in the Vietnam War, medical evacuation, hospitals and hospital care, medical supply, and medical personnel.

Types of Injuries and Diseases Encountered

Most people hospitalized in Vietnam were either as a result of disease or injury in combat.

Diseases

Disease was the biggest culprit in the welfare of Americans in combat in Vietnam. As can be seen in Table 1, approximately 69% of all admissions into hospitals for the Army were due to some kind of disease. Battle injuries and wounds only accounted for one-sixth of the admissions during this time. If we compare the figures from Table 1 with those of other wars, Tables 2 and 3, we can see some sharp contrasts: (15:33)

HOSPITAL ADMISSIONS FOR ALL CAUSES, U.S. ARMY (VIETNAM)

(Rate expressed as # of admissions per annum 1000 avg strength)

YEAR	ALL CAUSES	NON-BATTLE INJURY	BATTLE INJURY & WOUNDS	DISEASE	DISEASE AS % OF ALL CAUSES
1965	484	67	62	355	73
1966	547	76	75	396	72
1967	515	69	84	362	70
1968	523	70	120	333	64
1969	459	63	87	309	67

Table 1. (15:33)

HOSPITAL ADMISSIONS FOR ALL CAUSES, U.S. ARMY (KOREA)

(Rate expressed as # of admissions per annum 1000 avg strength)

YEAR	ALL CAUSES	NON-BATTLE INJURY	BATTLE INJURY & WOUNDS	DISEASE	DISEASE AS % OF ALL CAUSES
1950	1526	242	460	824	61
1951	897	151	170	576	64
1952	592	102	57	433	75

Table 2. (15:33)

HOSPITAL ADMISSIONS FOR ALL CAUSES, U.S. ARMY (WWII)

(Rate expressed as # of admissions per annum 1000 avg strength)

YEAR	ALL CAUSES	NON-BATTLE INJURY	BATTLE INJURY & WOUNDS	DISEASE	DISEASE AS % OF ALL CAUSES
China-Burma-India					
1942	1130	81	3	1046	92
1943	1081	84	6	991	92
1944	1191	96	18	1077	90
1945	745	80	4	661	90
Southwest Pacific					
1942	1035	178	25	832	80
1943	1229	171	12	1046	84
1944	1013	139	34	840	83
1945	990	99	48	843	85

Table 3. (15:33)

The average Army annual disease admission rate for Vietnam (351 per 1,000) was about one-third that in World War II (approximately 877 per 1,000) and more than 40% less than the rate in Korea (611 per 1,000). (15:32) Why was there so much improvement? Neel attributes the improvement to effective disease control. In Vietnam, disease control programs were begun in 1965 and they were maintained throughout the war. This was unlike World War II in which disease control was not begun until 1945, near the end of the war, and in Korea where there still was a delay but of less magnitude. (15:32) Lieutenant General Leonard D. Heaton, USA, attributes the improvement to a better understanding of the different types of infections and efforts in preventive medicine. (11:85-88)

There were many different types of diseases the medical services of the Army had to fight. Tables 4 and 5 depict lost days from duty and causes for admissions. The diseases could be divided into two general groups: those which affected few people, like hepatitis, but put them out of action for a long time, and those which affected many people, like diarrhea and skin disease, but only for relatively short periods. Malaria was widespread and put individuals out of action for a long time, a combination of the worst of both groups. Neel points out that, as the years progressed, the disease rates for diseases like malaria fell as preventive measures were implemented. Disease could not only be controlled but could be forecast with some accuracy. This was very valuable for the field commander planning combat operations. (15:33-34)

APPROXIMATE NUMBER OF MAN DAYS LOST FROM DUTY BY CAUSE AMONG US ARMY PERSONNEL IN VIETNAM, 1967-1970

CAUSE	1967	1968	1969	1970
Malaria	228,100	215,400	183,050	167,950
Acute respiratory infection	66,800	83,181	63,530	70,800
Skin diseases (including dermatophytosis)	66,400	64,832	50,790	80,140
Neuropsychiatric conditions	70,100	106,743	125,280	175,510
Viral hepatitis	80,700	116,981	86,460	85,840
Venereal disease (excluding carded for record (CRO) cases)	55,500	60,132	48,980	45,100
Fever of undetermined origin	205,700	289,700	201,500	203,500
Disease total	780,800	943,809	762,720	834,540
Battle injury and wounds	1,505,200	2,522,820	1,992,580	1,044,750
Other injury	347,100	415,140	374,030	309,670

Table 4. (15:34)

There were some problems with reporting some of the statistics depicted in the tables. One of the problems with the figures in the category "fever of undetermined origin" (FUO) is the tendency of some medical personnel to include other conditions like headache and backache. The statistics on malaria and hepatitis are more accurate because they could positively be identified in most cases. (15:33-34)

The acclimatization process had a significant effect on the high incidence of short duration diseases. Brigadier General George J. Hayes, Marine Corps, stated while speaking at the 1970 Pacific Command Conference:

> . . . there is a time reference with respect to diarrheal and upper respiratory disease and fevers of unknown origin . . . . The combination of change in circadian rhythm, and early acquired diarrhea, most certainly of viral origin, leads to about a six-week acclimatization period for the troops. After this time the incidence of such disorders in acclimatized troops decreases to a negligible level.

The 12-month rotation policy made the rates of these diseases higher because of the continual arrival of unacclimatized people. (15:36-39)

Like the Army, malaria and fever of undetermined origin were the major causes of hospitalization for members of the Navy and Marine Corps in Vietnam. The average patient stay for malaria was about 31.5 days. From interviews with the patients, it was suggested that the lack of following the proper preventive measures, such as taking chloroquine-primaquine tablets, accounted for many of the cases. (14:278)

SELECTED CAUSES OF ADMISSIONS TO HOSPITALS AND QUARTERS AMONG ACTIVE-DUTY US ARMY PERSONNEL IN VIETNAM, 1965-1970

(Rate expressed as # of admissions per annum per 1000 strength)

CAUSE	1965	1966	1967	1968	1969	1970
Wounded in action	61.6	74.8	84.1	120.4	87.6	52.9
Injury (except WIA)	67.2	75.7	69.1	70.0	63.9	59.9
Malaria	48.5	39.0	30.7	24.7	20.8	22.1
Acute respiratory infections	47.1	32.5	33.4	34.0	31.0	38.8
Skin diseases (including dermatophytosis)	33.1	28.4	28.3	23.2	18.9	32.9
Neuropsychiatric conditions	11.7	12.3	10.5	13.3	15.8	25.1
Viral hepatitis	5.7	4.0	7.0	8.6	6.4	7.2
Venereal disease (including CRO)	277.4	281.5	240.5	195.8	199.5	222.9
Venereal disease (excluding CRO)	3.6	3.8	2.6	2.2	1.0	1.4
Fever of undetermined origin	42.8	57.2	56.2	56.7	57.7	72.3

Table 5. (15:36)

Diseases such as malaria, hepatitis, dysentery, and others common to Vietnam did not have the same outcome towards Air Force personnel. In fact, the noneffectiveness rates due to medical causes were approximately the same in Vietnam as they were in the United States. General Richard L. Bohannon attributes this to Air Force's fixed-base operation in contrast to the Army troops who roamed throughout the jungles. The fixed-base environment allowed for more controls over the environment, water supply, food, housing, and general sanitation. (3:24)

The number one cause for disability for the flying personnel of the Air Force was respiratory infection, followed by dermatological conditions. Gastrointestinal diseases, such as upset stomach and diarrhea, were the next most common group. The immunization program is cited as the major deterrent to the diseases found in Vietnam. Nutrition and emphasis on hygiene standards also played an important part in combatting disease. (3:24-25)

Wounds

Wounds to Army soldiers in battle were received in a number of different ways. A breakdown is shown in Table 6:

PERCENT OF DEATHS AND WOUNDS ACCORDING TO AGENT VIETNAM JAN 1965 - JUN 1970

AGENT	DEATHS	WOUNDS
Small arms	51	16
Fragments	36	65
Booby traps, mines	11	15
Punji stakes	0	2
Other	2	2

Table 6. (15:54)

Weapons used by the enemy in Vietnam were more advanced than in previous wars which caused different and more serious wounds. The high velocity rounds from M16/AK47 type weapons created much more damage than did the low velocity weapons of previous wars. The tumbling action of many of the bullets accounted for larger entrance wounds. The extensive use of mines and booby traps in Vietnam created some serious medical problems. Dirt, debris, and everything else entered many of the wounds. This along with the severity of the wounds complicated the work of the surgeons. (15:53)

Another cause of wounds was the punji stick. The punji stick was a needle sharp bamboo stake with the tip smeared with human waste. The sticks were then put in traps in the ground awaiting unsuspecting victims. When someone would step on this stick and it entered the body, the body would soon become infected. The infection would travel up the leg, if not treated. (12)

Lieutenant Colonel William M. Hannon, Marine Corps, contends that the lack of use of helmets contributed to many of the injuries:

> If our combat troops . . . were to wear a helmet, we believe that about one-third fewer significant combat casualties would need to be admitted to a neurosurgical center here in Vietnam.

The troops who stayed in one place (air and ground vehicles) usually wore helmets and flak vests. Soldiers on the move found the equipment too heavy and hot and usually did not wear it. Some commanders decided not to use the protection because of the reduction in mission capability and increase in heat casualties. (15:55)

Aeromedical Evacuation

Aeromedical evacuation can be categorized into four separate systems: (1) forward aeromedical evacuation, (2) tactical and intratheater aeromedical evacuation, (3) strategic and intertheater evacuation, and (4) domestic flights. Evacuation from the field was usually by Army or Marine helicopters. Intratheater flights moved patients within the battle area and to US hospitals at bases in Japan, Okinawa, and the Philippines. These flights were the responsibility of Pacific Air Forces (PACAF). Strategic and intertheater evacuation was the responsibility of the Military Airlift Command (MAC). The domestic flights were also the responsibility of MAC. (18:17-18) M. S. White shows the breakdown of evacuations for the three services in a study he performed. The results showed the percentages of wounded evacuated as 60% Army, 35% Navy and Marine, and approximately 1% Air Force. (21:782)

Forward Aeromedical Evacuation

If one element of medical logistics were picked to be responsible for increasing the number of lives saved, it would certainly be the helicopter ambulance units. "Dust-Off" was the term given the aeromedical evacuations by these helicopter evacuation crews. Nearly all battlefield casualties were evacuated by U.S. Army UH-1 helicopter ambulances. Air Force helicopters occasionally assisted in these operations. (2:280) United States Army Major Pat Brady, Medal of Honor recipient, said:

> Dust-Off has been one of our greatest assets in Vietnam, not only for the service it provided for our troops but also for the great example it provided for our allies. (2:23)

The term "Dust-Off" came from Major Charles L. Kelly, the commander of the 57th Medical Detachment in Vietnam in 1964. Kelly took the call sign "Dust-Off" and, on a medical evacuation mission on 1 July 1964, was making an approach to pick up wounded from a particularly dangerous area. The enemy was waiting and opened fire. He was repeatedly told to withdraw but refused. A US advisor on the ground gave him a direct order to withdraw and Kelly replied, "When I have your wounded." A few moments later Kelly died with a bullet wound through the heart. Dust-Off became the call sign of all Army aeromedical evacuation missions in Vietnam, and "When I have your wounded" became the personal saying of many of the medevac pilots who followed Kelly. (16:7-8)

At the peak of combat operations in 1968, the Army operated 116 of the air ambulances. (2:280;15:70) These helicopters transported from six to nine patients at a time. The medical evacuation flights averaged about 35 minutes. The crew usually consisted of a pilot, copilot, medical aidman, and the crew chief armed with an automatic rifle. In less dangerous areas, the crew chief was left behind for additional space for patients. (2:281) Heavy armor plates protected the pilot's seat, cockpit doors, and cabin floor. The Geneva Convention stated that helicopter ambulances should have large red crosses painted on the sides, nose, and bottom. In Vietnam, the crews only painted a small red cross on the nose. The other crosses were painted out because the Viet Cong were thought to use the large red crosses

for targets. (12) Captain Ronald F. Hopkins, a pilot in the 2d Platoon, 498th Medical Company, said:

> We sometimes felt that VC are aiming particularly at the big red crosses on the side of our chopper, but they're probably shooting at any helicopters they see. At any rate, they do not respect the red cross at all. (17:22)

Originally there was no system of patient classification or categories of precedence. Then came the classifications of urgent - immediate attention within two hours, priority - attention within 24 hours, and routine - attention within 48 hours. Later, urgent was used to mean immediate evacuation to save life or limb, priority was used to mean 4 hours, and routine meant no expected deterioration for several hours. One of the problems with this system, identified by Major Pat Brady, was that individuals who classified the patient for evacuation were usually not qualified to do so. An untrained person does not realize that there is not necessarily correlations between pain and the seriousness of a wound. Some soldiers would call in a wounded friend's priority as urgent so he could be evacuated immediately when the classification should have been priority or routine. Overclassification was also a problem for the Dust-Off pilots since they pushed themselves many times for patients they thought were in the urgent classification but were actually not. (5:21) The number of patients evacuated by helicopter rose from 13,004 in 1965, to 67,910 in 1966, to 85,804 in 1967, and reached a high of 106,229 in 1969. In 1969 more than 104,112 missions were completed while flying about 78,652 combat hours. (15:9)

The Dust-Off crews who flew the acromedical missions had one of the most dangerous and difficult jobs in Vietnam. Landing and evacuations under fire were routine. Half the members of these crews earned Purple Hearts during their one year tour of duty. About 10% were killed. (12) In an interview by *Time* magazine, U.S. Army Major Paul "Big Bear" Bloomquist was asked why he continued to stay in Vietnam. Major Bloomquist had flown 750 combat missions, been wounded 3 times, won 27 citations, and rescued more than 800 wounded soldiers at the time. He also volunteered for a second tour of duty and refused to take leave after the first 15 months he was in Vietnam. He replied:

> Because, I like the excitement. And because I think that my crew and I can do this job better than anyone else. It's the job that counts above all, and it's the job that somebody has to do. (10:25)

This type of dedication was found in many of the medical evacuation teams in Vietnam.

Tactical and Intratheater Evacuation

Until January 1968, intratheater medical evacuation was performed by U.S. Air Force C-130s, C-123s, and C-7s. In January the C-118s of the 6485th Operations Squadron were assigned to fly in-country evacuation missions. Committing these aircraft was one of the great improvements of medical support in Vietnam. (2:281)

Working with medical agencies and the 834th Air Division, the 903d Aeromedical Evacuation Squadron provided scheduled service throughout the country. (2:281) Physicians decided priorities of how quickly patients should leave for destination hospitals. Like the Dust-Off classifications, cases were categorized as "urgent," "priority," and "routine." "Urgent" cases were those that must go immediately to save a life or prevent serious medical complications. "Priority" cases were those that needed prompt medical care not available locally. These patients were to be moved within 24 hours. All other patients fell into the "routine" category, and these patients had a time limit of 72 hours. (1:44) All "routine" and most "priority" cases could be handled on the regularly scheduled flights. Immediate movement of the "urgent" cases required aircraft in the air be diverted, or an alert aircraft be launched on a special mission. More than 65% of all the aeromedical evacuation missions within Vietnam were unscheduled. In 1966, C-130s accounted for more than 36,000 patient moves, averaging nearly 100 patients a day for that year. (18:21) During the period from July 1967 to January 1968, patient movements averaged 5,813 per month. From February 1968 to June 1968, the average was 9,068 per month. Almost 11 times each day, requirements were called in, missions set up, medical crews picked up, cargo offloaded, planes reconfigured, and patients evacuated. (2:282) Converting the cargo or passenger aircraft consisted of removing cargo pallets or passenger seats and installing the vertical poles to support the litters. The time to do this depended on the number of seats and litters needed for a specific flight. Starlifters were reconfigured in as little as 25 minutes. (18:21)

To understand the amount of work that was being done, an example of the number of casualties evacuated from Vietnam and Thailand is found in Table 7. These are from the monthly reports from the 9th Aeromedical Evacuation Group. Another study of evacuations from 1965 to April 1968 shows that PACAF had over 200,000 patient movements. This does not represent the number of patients moved, but the number of times patients were moved. Some patients had been moved more than once in the evacuation process. The study reported that 40% of these were battles casualties. (20:1339)

PATIENTS EVACUATED BY PACAF AIRCRAFT

	Month Ending 25 July 1965	Month Ending 15 June 1967	Month Ending June 1969
Intra-Vietnam	190	7023	9087
From Vietnam	607	2259	224
Intra-Thailand	11	175	176
From Thailand	41	239	9
Non-Southeast Asia	629	1703	598

Table 7. (4:400)

Strategic and Intertheater Evacuation

The Military Airlift Command had the responsibility for flights from Vietnam to the United States. At first the wounded were evacuated to Clark Air Base. From there they were routed to Tripler General Hospital in Hawaii, to the U.S. Army Hospital on the Ryukyu Islands, or to Japan. In the summer of 1966 the equivalent of 3½ general hospitals were established in Japan. These hospitals were for the wounded who could return to duty within 60 days. (15:77) Scheduled flights left from Tan Son Nhut, Cam Ranh Bay, and Da Nang Air Bases in Vietnam for Yokota AB, Japan. (18:18) These flights took approximately six hours. Those patients going to the hospitals in Japan got off. Other patients bound for the United States got on. Patients going to hospitals east of the Mississippi flew to Andrews AFB, Washington DC (18 hours via Elmendorf AFB, Alaska); and those patients going to hospitals west of the Mississippi flew to Travis AFB, California, by a direct 10-hour flight. (15:77)

Domestic Flights

MAC also was responsible for moving patients from their points of arrival in the United States to their final destination. The responsibility of determining a patient's destination was with the originating medical facility in conjunction with several regulating agencies. The first agency was the Far East Joint Medical Regulating Office (FEJMRO) in Camp Zama, Japan. If a patient was to be hospitalized in the Far East or Southeast Asia, FEJMRO determined where he would go. If the patient was to go to the United States, the Armed Services Medical Regulating Office (ASMRO), Washington DC, determined where in the United States that patient was to be hospitalized. When patients arrived at Travis AFB or Andrews AFB, they were then moved by trunk and feeder flights to their final destination. Trunk flights flew on a schedule between seven main transfer points in the US: Travis, Buckley, Kelly, Maxwell, McGuire, Andrews, and Scott AFBs. At the transfer point nearest their destination hospital, they boarded a feeder flight to the final destination. The 375th Aeromedical Airlift Wing Command Post at Scott AFB monitored all trunk and feeder flights. An aircraft took off or landed every 17 minutes. A "hot line" linked each of the transfer points to the command post at Scott. Status boards were kept at the command post to show how many patients needed to be moved, aircraft availability, and the progress of each en-route patient. (18:18-19)

Hospitalization

Hospitals of each of the services were located in different types of areas in Vietnam and had different missions. The injured were usually treated first by a buddy or a medic. They were then taken to an aid station, treated, and evacuated by helicopter to a clearing station. From there the injured would go to a forward hospital and, depending on the injury, be evacuated out of the country.

Army

The 8th Field Hospital at Nha Trang was the only U.S. Army Hospital in Vietnam until April 1965. This hospital had a 100-bed capacity. Attached to the hospital were four medical detachments. They provided specialty care, but were entirely dependent on the hospital for logistical support. The 3d Field Hospital arrived in Saigon in April 1965. Between April and December 1965, two surgical hospitals, two evacuation hospitals, and several numbered field hospital units (initially located with the 8th and 3d Field Hospitals) were deployed to Vietnam. By the end of 1965, the total number of hospital beds in-country had increased to 1,627. The deployment of additional hospitals continued throughout 1966 and 1967. During this time, four surgical hospitals, six evacuation hospitals, and another hospital unit of a field hospital were deployed. The medical unit buildup was completed in 1968 with the arrival of one surgical hospital, three evacuation hospitals, additional field hospital units, and 11 Reserve and National Guard medical units. By December 1968 there were 5,283 Army hospital beds in Vietnam. (15:60-61)

In 1965, a variable 15- to 30-day evacuation policy was in effect. Under this policy, 40% of those injured through hostile action and 70% of other surgical patients were returned to duty. By mid-1966, the number of beds had increased to permit a change to a 30-day policy. Patients who could be treated and returned within 30 days stayed in Vietnam. Patients requiring more than 30 days of hospitalization were evacuated out of country as soon as they could be moved. The greatest factor in the determination of the number of hospital beds required was the policy to keep 40% of the operational beds available to support unexpected surges of casualties. The occupancy rate exceeded 60% twice: in May 1967 it approached 67%, and in the 24-hour period during the Tet Offensive in February 1968, it increased to more than 65%. (15:60)

MUST (Medical Unit, Self-Contained, Transportable) surgical hospitals were used with some success in Vietnam. They had an expandable operating room and inflatable wards. Each unit had three parts and weighed approximately 3,600 pounds. It could be transported in a truck. It was designed with a gas turbine that provided electricity, and also had air-conditioning, heating, hot and cold water, and sanitation service. (12) The inflatable portions of the facilities were many times deflated during an enemy attack or near misses. The transportable attribute of the facilities was not used to the fullest extent and, in many cases, the MUST hospitals operated only from fixed locations. (15:67)

Air Force

In 1965 the Air Force had 2 Class "A" dispensaries and 11 Class "B" dispensaries in Southeast Asia. The medical personnel realized they needed more dispensaries, casualty staging units, and hospitals. Because of the shortage of material and lack of time, in 1966 the Air Force decided to procure prefabricated, modular type buildings to use as medical facilities at Da Nang (100-bed casualty staging facility) and Takhli, Thailand (10-bed dispensary). The Thailand site was later changed to U-Tapao. A contract was awarded for the manufacture of these two modular medical facilities, and they were both completed in 59 days. The first package arrived in Da Nang in mid-August 1966 and the second at U-Tapao in early September. Both were operational by late November, a total of 8 and 10 months, respectively, from initial development to operational status. By mid-1969 there were 19 of these types of medical facilities in use. (2:273)

The prefab unit was 10 feet wide by 40 feet long, with several of these joined together to form a medical facility. These buildings had electrical systems, water supplies, waste plumbing, air conditioning, heat, finished interiors, vinyl tile floors, and adequate lighting. The completed facility had waiting rooms, nurse's stations, dining areas, operating rooms, X-ray rooms, wards, and corridors. These facilities allowed the Air Force medical service to expand fast enough to care for the

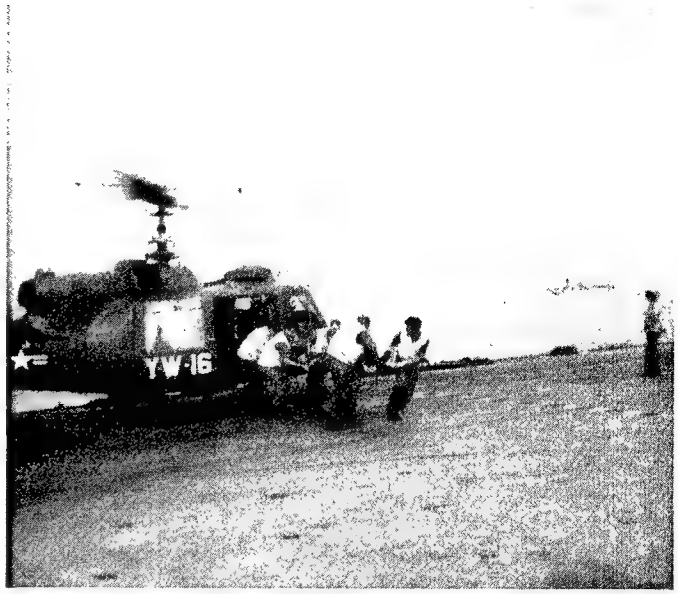
growing patient load. During 1967-1968 the inpatient facilities grew substantially. By June 1969, there were 3 hospitals, 12 Class "A" dispensaries, 2 Class "B" dispensaries, and 5 aeromedical evacuation staging facilities. (2:275-276)

The hospital which treated most of the seriously wounded casualties from Vietnam was the USAF Hospital Clark at Clark AB, Philippines. This multimillion dollar hospital had most of the latest medical equipment and was only 3 to 4 hours flying time from the zone of hostilities. The 13AF band saluted the sick and wounded as each flight arrived and departed. This was a welcoming touch for the evacuees as well as the medical personnel. Upon arrival, the casualties were divided into three categories: those remaining overnight and to be air-evacuated to another facility the next day, those too ill to travel who must be treated at Clark or must stabilize before traveling, and those Air Force patients who can be treated and returned to duty within 120 days. About 35% of the casualties brought into Clark were a result of hostile action. Most (about 55% to 60%) of the casualties were from diseases rather than wounds. Malaria, amoebic dysentery, and hepatitis were frequently encountered due to the poor living conditions. Most of these patients were treated and returned to duty. About 6% of the casualties were psychiatric cases. The hospital, while caring for the wounded from the war, carried on other normal functions like research on malaria and other tropical diseases, and offered medical training to interns and medical officers from other countries under the Military Assistance Program. (19:85-87)

Navy

When one thinks of the Navy, ships usually come to mind. The USS *Repose*, the Navy's hospital ship, was brought into service in the summer of 1965. With the escalation of the war, the ship underwent a $9 million facelift. (9:233-234) The ship was a 560-bed hospital (could be increased to 750 beds) with 25 physicians, 3 dentists, 7 Medical Service Corps officers, 2 chaplains, 29 nurses, 8 dental technicians, and over 200 hospital corpsmen in all technical specialties. (14:272) A helicopter pad could receive wounded by air and, if weather precluded transportation by air, patients could come aboard through the use of one of four ladders. Electronically driven hoists were used to bring the litter patients aboard. On the *Repose* was the most modern laboratory equipment and advanced diagnostic equipment of the day. (9:235-237) Some of the equipment onboard were the Baylor Beall heart-lung machine (a device used to pump blood while surgeons operate on the heart), ultrasound equipment used to locate shell fragments deep inside the body, and a bank for storing frozen red blood cells (which lasts indefinitely unlike whole blood which lasts only 21 days). (13:98; 103) Also onboard was an artificial kidney machine. The doctors used these machines when kidney failure followed an attack of malaria. (12)

The *Repose* and the USS *Sanctuary* (to be discussed later) were under the control of the Seventh Fleet. The ships were usually stationed near sites of the heaviest action. The *Repose* seldom left the combat zone and in December 1967 continued to gain new heights by reaching the 5,000th helicopter landing that month. This was followed by the 6,000th on 30 April 1968, the 7,000th on 22 June 1968, the 7,000th on 22 June 1968, and the 10,000th safe helicopter landing in January 1969. By December 1968, nearly 17,000 casualties had been admitted to the *Repose*. Approximately 7,000 of those were for wounds and the rest for treatment of disease or other injuries. (14:275-276)



Medevac helicopter transports wounded soldier to a ship for medical care.

Another hospital ship was the *Sanctuary*. A week after the *Repose* had anchored off the coast of Chu Lai, the *Sanctuary* was pulled from the Reserve Fleet and overhauled and outfitted. The ship arrived in Da Nang Harbor on 10 April 1967. The capacity was essentially the same as the *Repose*. During the remainder of 1967, more than 4,000 patients were admitted to the *Sanctuary*, and an average of 389 beds were occupied daily. In 1968, 6,799 patients were admitted, including 2,360 patients hospitalized for wound treatment. (14:275-276)

The Navy also had a station hospital at Da Nang. Construction of the hospital began in July 1965. Construction continued until 28 October 1965, at which time the enemy overran the area and did some extensive damage. After this, building started up again and, on 10 January 1966, the hospital opened with 60 beds. By July, it had expanded to the originally planned 400-bed capacity. It continued to grow with the increased need for medical care. An additional 200-hundred bed component was added in 1968, and in 1969 a temporary expansion to 700 beds was authorized. This was due to the many malaria cases. The hospital was staffed with 48 physicians, 20 medical service officers, 12 dentists, 34 nurses, and 485 corpsmen. The hospital was primarily for the use of Navy and Marine Corps in the combat zone and for furnishing dispensary services to other eligible people. The figures for the numbers of patients treated are amazing. During 1968, 23,437 patients were admitted to the hospital. This entailed over 150,000 sick days. During May 1968, more than 2,500 were admitted, an all time record-high for admissions. Of the total treated, 51% were treated for wounds or injuries, requiring more than 23,000 major surgical procedures. (14:272-276) During the four years the hospital was under the Navy's management, 66,007 patients were treated. 21,523 of these patients had combat related injuries. In addition, 958,051 people received outpatient care. (7:220) Commander Frank Collins tells a story of a live 60-mm mortar round being removed from the chest of Private First Class Hguyen Luong, ARVN. This operation was performed by Naval Medical Corps Captain H. H. Dinsmore and Chief Engineman J. J. Lyons, a Navy explosive ordnance demolition expert. The two individuals worked in an area surrounded by sandbags, in case the mortar went off, and removed the round. When lifting the round out, the detonating plunger was just millimeters away from the explosive squib. (7:220)

The Marine Division medical support consisted of different medical elements at various headquarters and regiments, and the medical battalion. The medical battalions were separate supporting battalions within a division. The battalion consisted of a headquarters and clearing companies. The headquarters had the command element, preventive medicine section, motor transport section, and the medical records section. Collecting and clearing companies had a company headquarters, two clearing platoons, and one collecting platoon. The clearing platoons operated a 30-bed clearing station. The flow of a wounded person was supposed to be from the field to the battalion aid station, to the collection and clearing company, and then to the designated ships of the amphibious task force. With the use of helicopters, the battalion aid stations were often bypassed. Battalion aid stations had limited capabilities, with only a 48-72 hour holding capability. Each headquarters of a division had a dispensary that was to provide day-to-day medical care to the unit. (15:259-260)

Medical Supply

Medical supplies for each of the services were managed in different ways, and different problems were encountered due to the different missions of each service.

Air Force

Initially, Clark AB had the responsibility for medical materiel support for all USAF medical units in the Philippines, Taiwan, and Southeast Asia. As the war soon escalated, the demands on the Clark medical supply account exceeded the capabilities. Shortages of medical supplies did sometimes hamper the medical operations in the war zone. Many people worked many long hours trying to get supplies in and out as fast as possible. It was not uncommon for a ship with medical supplies destined for Clark to remain weeks at anchor at a Vietnamese port for unloading war materiel, before continuing its voyage to Clark. This logistical problem increased pipeline time for medical materiel to Clark by an additional 60 days in October 1965, and as much as 75 days in November. Only the most essential items were allowed to be airlifted to Clark. Anything less than an emergency shipment was usually sent by sea.

The distribution of medical supplies from Clark to Vietnam and Thailand was not a problem. This was accomplished by a large fleet of USAF transport aircraft. The routes and frequency of flights normally assured delivery between several days to two weeks after requisition. An attempt was made to speed deliveries by the initiation of port-to-port cargo hauls in which, for example, a ship going to Cam Ranh Bay would be loaded with cargo solely for that port.

In 1966, Clark was relieved of the responsibility for the entire area. Separate medical supply accounts were set up for South Vietnam, Thailand, and Taiwan for the medical units in those countries. In July 1966, the medical supply account at Cam Ranh Bay took over the responsibility of resupplying all USAF medical units in South Vietnam. In January 1967 accounts were also established at U-Tapao airfield, Thailand, and Ching Chuan Kang AB, Taiwan. The addition of these accounts got rid of most of the medical supply problems described earlier. (2:276-277)

Army

When the Department of the Army headquarters was reorganized in 1962, medical supply was incorporated as part of the normal supply network. This was done even though the command surgeon objected to the change and said that there would be a serious deterioration in support to medical facilities and medical units. Under this system supply management was centralized at the Inventory Control Point in Hawaii. The Inventory Control Point was responsible for all requisitioning of supplies within the United States Army in the Pacific (USARPAC) as well as the centralized maintenance of records on the status of supplies in Korea, Japan, Hawaii, and Okinawa. (15:80)

The problem of treating medical supplies just like any other category of supply items became apparent in 1965 with the buildup of troops in Vietnam. One of the most significant problems was the lack of adequate medical supply personnel and the lack of continuity in key positions. This was a result of the 12-month Vietnam tour of duty. (15:80)

The task of medical supply distribution to the medical supply units in Vietnam was the responsibility of the 8th Field Hospital

at Nha Trang which did not have an adequate staff to manage the requirements. The situation was worsened because the 32d Medical Depot, which was ready in July 1965, did not deploy until late October. One supply depot had been deployed in July and another shortly after, but they did not have the necessary ability to manage supply activities of this scale. (15:81)

The Surgeon General coordinated with the CINCPAC to fix the problem. In July 1965, they jointly established a system of automatic shipments of medical items to Vietnam. The items shipped were primarily medical resupply sets and later optical resupply sets. This temporary measure was not very successful. Delays in shipments from the United States, off-load procedures in Vietnam, and the splitting of resupply sets into various shipments were the major problems encountered. (15:81)

By mid-1965 the Army medical supply system was about to fall apart because of the lack of qualified medical logistics personnel, the problems of the medical resupply system, and the inability of the centralized management system in Hawaii to meet the medical supply needs in Vietnam. In November 1965, the Vice Chief of Staff directed the Surgeon General to find out what the problem was and make recommendations to correct it. The investigation found that the Inventory Control Point in Hawaii could not provide pertinent data on the medical supply situation within USARPAC. This meant that requisitions were being processed and supplies were being sent without the full knowledge of subordinate command conditions, environment, or professional requirements. The Inventory Control Point provided little assistance to the subordinate commands or to the surgeons. The report indicated the medical supply system was not large enough to require a centralized and functionalized management system, but it was important enough that it should. The Surgeon General recommended the Army Medical Department be given control over medical depots and medical inventory control activities. This recommendation was approved by the Chief of Staff and began in the summer of 1966. (15:79-81)

Under this realignment, the responsibilities of the Inventory Control Point shifted to the U.S. Army Medical Depot in the Ryukyu Islands. This depot ordered replenishment supplies directly from the U.S. Army Medical Materiel Agency (USAMMA) in Phoenixville, Pennsylvania. The effect of this realignment was USAMMA's ability to maintain control and follow up on each requisition to ensure the requesting agency was well informed. (15:81)

In 1967, the medical supply section of USARPAC, the Materiel Management Agency, was transferred to the Chief Surgeon, USARPAC. This put all the medical supply activities in the Pacific in medical channels. In each subordinate command, medical supply responsibilities were assigned to medical commanders and surgeons. The 32d Medical Depot, which deployed in October 1965, provided medical supplies for units of the U.S. Army and the Armed Forces of Korea, the Philippines, Australia, and New Zealand. In 1968, the 32d Medical Depot issued about $30 million of medical supplies and filled more than 85% of all requisitions. Despite chronic shortages of personnel and equipment, this Depot performed in an outstanding manner. (15:80-84)

Reliable transmission of requisitions and supply information was a continuing problem within Vietnam. The primary ways used were transceiver, mail, and telephone. Transceiver was most commonly used. Batch control techniques were begun to prevent losses of information. This was very successful. (15:85)

Transporting medical supplies within the depot system was also difficult at times. The road network was very poor and there often were attacks by the enemy. High priority requisitions were delivered by helicopter from the designated supply points. Bulk quantity shipments were packed in Conex containers and airlifted by Chinook helicopters. (15:85)

The lack of storage space for medical supplies was another problem. When troop movements were planned, storage requirements for medical supplies were frequently overlooked. During the early part of the war, there was lack of covered storage areas for perishable and other delicate medical supplies. The efforts of the 32d Depot overcame most of these problems and facilities for the proper storage of medical supplies were constructed. (15:85)

Medical Personnel

The injured in Vietnam received medical attention from many different levels of medical personnel from all the services.

Combat Medic

The wounded person in Vietnam usually received his first medical attention from a medical corpsman. His first concern was to stop the bleeding, to ensure the breathing airway was clear, and to close open wounds. He would then move the injured person to a place where he could receive more extensive medical care. (12) The corpsman (or medic) was assigned to the smallest of units. Some units would have more than one. His job was to see that first aid was given to the wounded in the field. He had many other tasks such as ensuring potable water was available and, if water was not available, ensuring the men used their water purification tablets; ensuring defecation holes were kept free from disease; ensuring the food was good; and ensuring the general health of the men did not deteriorate. He also had the responsibility for keeping the commanding officer advised of all health related problems. (9:227) Medics were often high priority targets. The Viet Cong were known to call out "Medic" or "Corpsman" and, when the medic showed himself, they would shoot him. Some of the medics would shoot back, but many of them were conscientious objectors and did not carry guns. (12)

Triage Officer

The triage officer was one of the most important people in the hospital when the wounded came in. His job was to direct or sort the injured so the greatest good could be accomplished for the greatest number. He checked over the wounded and decided which of the injured required immediate surgery, which of them could wait a few hours, and which of them needed only minor treatment. A good triage officer did not get involved in the treating of cases. If this happened, the patients would pile up and some emergency cases would not be cared for. (12)

Surgical Officer

The job of the surgical doctor was very difficult and demanding. He often had to perform advanced surgery beyond his experience or maturity. A study shows that of those wounded seriously enough to be hospitalized (47,483 from 1 January 1961 to 7 October 1967), about 51% returned to duty within one month, and 70% went back to duty eventually. (12) This is a tribute to the work of the surgical doctors and their staffs.

Flight Nurses

When the patients were being airlifted out of Vietnam, the flight nurses played a very important part in their successful evacuation. Very few casualties died while in the air: a tribute

to the flight nurses since most evacuation flights did not have doctors onboard. During air evacuations, the flight nurses had many responsibilities and performed jobs usually left to qualified physicians. They administered blood transfusions and intravenous feedings, treated shock victims, performed emergency tracheotomies, and performed other emergency procedures. They not only had to deal with the wounded but with the victims of malaria, dysentery, and other diseases. The average age for the Air Force nurses was 28 years old. This duty was considered the most prestigious assignment by the AF nurses and not one requested a transfer during the entire war. There were 54 PACAF flight nurses who operated in the Southeast Asian area. MAC had 67 flight nurses who were responsible for the flights back to the states. Both had difficult jobs. The PACAF nurses had to care for the recently wounded in short, turbulent flight missions. The MAC nurses supported patients for the long flights over the ocean. The PACAF nurses' working day averaged 12-14 days with 8 hours in the air. The MAC nurses put in as many as 105 hours on a roundtrip over the ocean. Why did these nurses continue to perform such difficult missions? Senior Flight Nurse Major Jean A. Corrigan says:

> The first few flights are toughies. It's scary knowing so many lives depend on just you. But somehow even our youngest nurses mature almost overnight. They seem to grow a sort of shell just thick enough to hide heartache.

Senior Flight Nurse Major Lola Ball said:

> If the men can make such a sacrifice and still smile, we can do our bit, too. I keep remembering a claymore casualty we flew home. He was just a kid, really, and there was nothing much left of him - no arms, legs, eyes, just that big heart beating. Each time I checked to see how he was doing he whispered 'Just fine, Ma'am, thank you kindly.' Sometimes it hurt so much inside you just crawl back to your quarters and have a quiet cry.

Through all this, it was important for the air evac nurses to look attractive at all times. They knew that the injured wanted to see an ordinary American girl. The perfume atomizer was just as important as the medical kit. (8:75-79)

Summary

So, how effectively was medical logistics performed in Vietnam? Overall it was very effective. The medical personnel had to deal with disease as well as the wounded. They did that very well, as shown by the statistics. The wounded were brought to medical attention quicker than ever before in history through the use of the helicopter. Medical care at all hospitals was excellent and contributed to the survival of the wounded even though the types of wounds were worse than had been seen in previous wars. There was an excellent system for evacuating personnel out of Vietnam to the United States, and movement within the United States. The medical supply system was good but had some problems. Attempts to correct those problems were made and many succeeded. Finally, the medical personnel who served in Vietnam were of the highest caliber. They never slowed down as long as there was an injured or sick person in need of medical attention. The medical personnel and the medical logistics involved in Vietnam are probably the best ever witnessed. But, that does not mean improvements could not have been made nor does it mean that improvements in future conflicts should not be made. They should.

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Air Force Logistics Management Center (AFLMC) FY90 Program

Periodically, AFLMC contributes to this portion of the Journal. Our last contribution appeared in the Spring 1989 edition. Many of the projects in that listing have been completed, and we sincerely hope the Air Force logistics community is more effective because of them.

Cooperative efforts outside the Center have been outstanding. Personnel from MAJCOMs and bases have helped by providing "real world" data, test-bed sites, survey participants, "sounding boards" for new approaches, and key recommendations on better ways to solve logistics problems.

Below are our top projects for FY90. If you are interested in any of these projects, please contact the project officer. If commercial lines are used, dial Area Code 205, 279-plus the last four digits of the AUTOVON number.

FY90 Projects

Wartime Vehicle Visibility
Objective: Complete a research study to: (a) develop a functional description of the process for determining and meeting vehicle requirements in support of an operational plan, and detail the responsibilities, activities, and data flow for this process; (b) determine if duplicate vehicle taskings exist (war reserve materiel (WRM) resources in the supported command and mobility resources in the supporting command); and (c) determine possible causes for duplicate vehicle requirements, draw conclusions, and make recommendations.
SMSgt Champlin, Joseph M., AFLMC/LGT, AV446-4464

Analysis of Inventory Dynamics
Objectives: Provide policymakers with the information they need to explain the extent of the Air Force inventory growth problem. Implement revised policies to intelligently reduce excess inventories.
Maj Bailey, Jeff, AFLMC/LGS, AV446-4165

War Reserve Materiel (WRM) Surveillance Checklist
Objective: Develop a comprehensive WRM checklist for logistics planners showing them the "why, when, where, what, and how" questions of surveillance visits.
Capt Fryer, Larry M., AFLMC/LGX, AV446-3535

Construction Branch Chief Guide
Objective: Develop and publish a construction branch chief guide which provides guidance on daily management and supervisory responsibilities; suggestions/recommendations on how to manage branch workload, personnel, and resources, based on lessons learned by experienced/successful branch chiefs; necessary interaction and interface with other branch chiefs and base level functional areas; and examples on how to avoid and solve potential solicitation and contract administration problems.
Lt Col McCarthy, Donald J., AFLMC/LGC, AV446-4085

Supply Material Facilities Entry-Level Training
Objectives: Identify the appropriate performance objectives for an entry-level materiel storage and distribution (MS&D) specialist and develop a prototype lesson for MS&D specialists. Also identify the hardware configuration needed at each base to use the computer-based training (CBT) materials.
Lt Col Peterson, Tim O., AFLMC/LGK, AV446-4166

Vehicle Operations Automation Study
Objective: Produce a research study to show: (a) software developed by transporters assigned in various major commands; (b) an evaluation of the capability of these programs to meet Air Force requirements; (c) recommendations regarding near-term release of programs that may be widely useful without modification; and (d) the required changes or modifications needed to make the "best" programs viable resources for distribution to all base-level transportation units.
Capt Patrick, Eric W., AFLMC/LGT, AV446-4464

Stand-Alone LOGMOD-B, Phase II
Objective: Develop a limited stand-alone LOGMOD-B system to work in conjunction with the current mainframe LOGMOD-B. It will allow the user to download data from the mainframe, manipulate that data, produce output products, and then upload the changes back into the mainframe LOGMOD-B system. It must be compatible with the current Air Force standard microcomputer and printer.
Capt Talley, Mark, AFLMC/LGX, AV446-3535

Data Base Verification for Manpower Validation
Objective: Develop guidance which will explain how the manpower reports select data from the base contracting automated system (BCAS) database. Provide instructions for building reports which will assist managers in analyzing BCAS data. Explain how these reports can be used to identify database errors and how to correct these errors prior to running the manpower reports.
MSgt Dupin, George F., III, AFLMC/LGC, AV446-4085

Procurement of Dolly Sets
Objective: Determine the most efficient method of standardizing the procurement of dolly sets; i.e., a method that will ensure they are available when needed.
Maj Siler, Milton T., AFLMC/LGT, AV446-4464

Mobility Bag Inventory System II (MBIS-II)
Objective: To enhance the current MBIS programs to further meet the requirements of the base-level mobility units.
MSgt Martinez, Juan, AFLMC/LGS, AV446-4165

Automated Capability Assessment
Objective: Produce a computer-based version of the USAFE Collocated Operating Base (COB) Assessment Model.
Capt Talley, Mark, AFLMC/LGX, AV446-3535

Deputy Commander for Maintenance (DCM) Handbook Update
Objective: Update and expand the DCM Handbook for the DCM Course at the Ira C. Eaker Center for Professional Development.
Maj Wolford, Bethany R., AFLMC/LGM, AV446-4581

Contractor Performance Tracking System
Objective: Perform a study to determine the feasibility of developing a tracking system for contractor performance.
MSgt Ayers, Randy K., AFLMC/LGC, AV446-4085

Streamlined Source Selection Training Guide
Objective: Develop a training guide on streamlined source selection procedures that will be applicable to operational commands. The guide will identify and explain the presource selection process, the actual evaluation process, and the final award phase. Samples of required documents will also be provided.
Capt Crumbie, Betty A., AFLMC/LGC, AV446-4085

Vehicle Replacement Cycle Model

Objective: To find a better way to establish vehicle replacement cycles.

Capt Harris, Michael G., AFLMC/LGT, AV446-4464

An Automated Method to Compute Consumable WRSK Requirements

Objective: Develop a microcomputer program to compute the range and depth for a consumable war readiness spares kit (WRSK) and produce an "easy-to-use" management report for external review by maintenance/supply personnel.

Capt Crimiel, Dennis, AFLMC/LGS, AV446-4165

Concept of Operations (CONOPs) for Logistics Readiness Centers (LRC)

Objective: Develop and publish a Concept of Operations designed to aid the commander during the transition from peace to contingency execution. The CONOPs will explain, in generic terms, the concept of LRC operations, start-up and execution procedures, basic manning philosophy/requirements, checklists, and minimum mandatory reporting criteria. The CONOPs will be designed to allow for cross-command use and implementation. Our ultimate objective is for USAF/LEYX to publish this CONOPs as a 28-series Air Force Pamphlet or Manual.

Capt Branson, Randel L., AFLMC/LGX, AV446-3535

Support General Implementation for Non-TAF Commands

Objectives: Assist HQ SAC, MAC, AFRES, and NGB in developing job standard tables required for the Support General Estimation Model (SGEM). Also assist with instructions on operation of the program and implementation at MAJCOM and base level. In addition, work with the Standard Systems Center on completion of necessary core automated maintenance systems (CAMS) changes, and complete two new User's Guides for the program (one for MAJCOM level and one for base level personnel).

Maj Wolford, Bethany R., AFLMC/LGM, AV446-4581

WRM Management Tools

Objectives: Make an accurate and comprehensive appraisal of current base- level WRM management requirements. Also assess the management tools currently available to base logistics planners to meet these requirements, identify any gaps between management requirements and available tools, and make recommendations for improving WRM management.

1Lt Long, Christopher D., AFLMC/LGX, AV446-3535

Freight Documentation Automation (FDA) Revision (Version 3.0)

Objective: Test, evaluate, and distribute FDA software and documentation changes developed by the Transportation Systems Center (TSC).

Capt Mohr, David W., AFLMC/LGT, AV446-4464

Operational Contracting Data Bank

Objective: Explore the feasibility of developing an AFLMC BCAS Data Bank to monitor management information in the contracting community. The BCAS Data Bank would be used to analyze workload factors, administrative lead times, priority purchase requests, and other data available in the BCAS.

MSgt Dupin, George F., III, AFLMC/LGC, AV446-4085

Incorporation of Weight and Cube Into the Standard Base Supply System (SBSS)

Objective: Study the feasibility of incorporating weight and cube information into the SBSS and, if feasible, develop a plan to incorporate data.

Capt Ballen, Denise, AFLMC/LGS, AV446-4165

Analysis of EOQ Range Criteria

Objective: Analyze the four current economic order quantity (EOQ) range criteria to determine if base supply accounts are stocking new items that should not be stocked.

Lt Col Matthews, Edward C., AFLMC/LGS, AV446-4165

Stock Funding Depot Level Reparables (DLR)

Objectives: Determine automatic data processing (ADP), manpower, and training requirements for stock funding of depot level reparables and perform a test of base level policies and procedures. Also provide base-level expertise and guidance to other implementation working group (IWG) panels and track the implementation of DLR stock funding at base level.

Maj Lewandowski, Francis, AFLMC/LGM, AV446-4581

Warranty Administration

Objectives: For a given warranted contract, or series of contracts, quantify the dollar impact upon the Air Force for warranty administration, assess the administrative and man-hour burden on "Blue-Two," and assess the practicality of the particular warranty administration techniques employed.

Capt Martin, David P., AFLMC/LGM, AV446-4581

Analysis of Order and Ship Time (O&ST)

Objectives: Describe the process used to collect data as well as analyze the alternate methods of computing the data for O&ST. Also determine the impact of variations, determine whether any of the computation methods are superior, and make recommendations accordingly.

Capt Silver, Bradley D., AFLMC/LGS, AV446-4165

Feasibility of a Base-Level Indentured Parts System

Objectives: Study the feasibility of building a Standard Base Supply System indenture database. Then, if determined to be feasible, develop a plan to implement a base-level indenture data system.

SMSgt Johnston, Rosemary, AFLMC/LGS, AV446-4165

Evaluation of CAMS Bar Code Implementation

Objective: Evaluate bar coding CAMS input data and provide implementation cost estimates to include establishment of bar code tables for the Aircraft Maintenance Unit involved in the test and man-hour savings.

SMSgt Pate, Benjamin S., AFLMC/LGM, AV446-4581

Evaluation of the Effectiveness of the Fault Isolation Process in Today's Technical Order System

Objective: Give the Air Force a snapshot of where we are today in terms of the extent and effectiveness of fault isolation manual use. (NOTE: This project consolidates two previous AFLMC pending projects with new guidance from HQ USAF. They are LM850430, Improved Troubleshooting for Fault Isolation Manuals, and LM850407, Fault Reporting and Isolation Manual Feedback Systems. These projects will be closed, and their objectives will be addressed in this project.)

Capt Silva, James T., AFLMC/LGM, AV446-4581

Review of Standard Reporting Designator (SRD) Code Assignment

Objective: Describe an SRD assignment scheme which will enhance the usefulness of historical consumption data.

Maj Duke, James A., AFLMC/LGS, AV446-4165

Let's Join the Quality Revolution

Colonel Kenton R. Ziegler, USAF
Chief of Propulsion, OC-ALC
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Introduction

"Quality" is one of the most popular catch words today. United States (US) industries are stressing improved "quality" in the manufacture of their products, which must compete in the open market against Japanese, German, and other international goods famous for their extraordinary "quality." The competition is intense. The effort to improve "quality" is changing the manufacturing processes used by industry and is clearly reflected in the advertising campaigns of major US and international companies. At Ford, "Quality is Job 1." At Quaker State, "The Q Stands for Quality." If you make Zenith television sets, "The Quality Goes in Before the Name Goes On." Chrysler chairman, Lee Iacocca, has issued a "Buyers' Bill of Rights" that says buyers have a right to top quality cars that look good, drive smoothly, and do not break down. The leadership in America's large companies is now more committed to improving the "quality" of American-made products across-the-board. This effort is a matter of survival in many cases for, without better "quality," America's share in the marketplace will continue to decline. Such a decline would have a tremendous effect on the ability of the US to overcome its foreign trade imbalance and its ability to reduce the growing national debt. Based on sales improvements and consumer reports, industries' efforts to raise "quality" are working. This paper will investigate the methods private industries are using to improve production processes and the "quality" work of their employees. We will then try to relate that to the efforts on-going within the US Air Force to improve the "quality" of work done in the aircraft maintenance area. Specifically, we hope to give maintenance leaders at the flight-line level a guide to improve maintenance "quality" performance and production by applying successful techniques used in industry today.

It would be inaccurate to say our Air Force has a bad "quality" program. Efforts by our technicians, supervisors, and Deputy Commanders for Maintenance (DCM) in all the commands have helped improve readiness rates of aircraft across-the-board. The decade of the 80s saw dramatic improvements in the reliability, maintainability, and sustainability of the fleet. Headquarters Air Force initiated a project named R&M 2000 (Reliability and Maintainability 2000) to look into the future in an effort to improve the reliability and maintainability of current and projected weapon systems. Funding for spare parts, incentives for manufacturers to build reliable products, and an intentional effort by the weapon system acquisition community to make reliable performance a part of each contract all played roles in improving readiness rates. Spare parts purchases from significantly improved funding in the early 80s helped overcome dismal parts availability and dangerously low readiness rates from the 70s. System Project Offices (SPO), responsible for purchasing new weapon systems for the Air Force, included reliability and performance standards in the specifications sent to manufacturers. Dollar incentives were awarded to manufacturers whose product performance exceeded specification standards. As a result, older systems like Air Training Command's (ATC) T-37s and T-38s were able to produce sufficient sorties to train new pilots. Tactical F-15s, F-16s, and A-10s ended 1989 with mission capable (MC) rates approaching 90%. These rates compare with MC rates in the 60%-70% range during the 1970s. These MC rate improvements are important because they equate to better combat capability. Compared to 70% rates in the 70s, a typical 72-aircraft F-16 wing with a 90% MC rate in 1989 has 14 more combat capable aircraft available every day to meet training sortie requirements, to fly combat missions, or to deter a potential enemy from initiating hostilities.

The concern is that the superior funding support the Air Force has had for spares, for reliability incentives, and for acquisition program specifications is diminishing as we enter the 1990s. The Air Force is entering a period where maintenance people on Air Force flight lines will be expected to maintain high standards and 90% MC rates but with fewer spare parts and reduced funding for SPOs and the Air Force Logistics Command (AFLC) as they attempt to buy reliable new systems and parts. Efforts to keep high readiness rates will put pressure on technicians and their leaders to "do more with less." In such an environment, "working harder and smarter" will help, but may not be enough. Adding true "quality" to the "harder and smarter" equation may be one of the answers.

But, "quality" does not just happen. Producing "quality" work, whether on the Air Force flight line or in the nation's manufacturing plants, requires a sincere, dedicated, intense effort that must be guided and directed through a well-thought-out "quality" program. Is the Air Force prepared to improve "quality"? Does the Air Force understand how industry has applied "quality" principles and processes to improve their products? Or does the Air Force maintenance community need a fresh start in its efforts to improve the "quality" of its aircraft maintenance on the flight line and in shops at wing level?

Today, "quality" is expected to be a side benefit that results when technicians perform by the book. On flight lines and in maintenance shops, the focus of supervisory attention is on getting the people to follow the steps spelled out in Air Force job guides and technical data. Very little emphasis is placed on getting maintenance technicians to recognize they are the keys to producing "quality" maintenance. Air Force maintenance organizations follow the age-old practice of having Quality Assurance (QA) personnel inspect completed tasks to see if the work meets acceptable standards. Inspecting-in "quality" simply does not work. The thesis of this paper is that "quality" must be ingrained in the minds and attitudes of technicians "before" they do maintenance. If "quality" is not built in, it is certain that inspectors will find less than acceptable work when they inspect at the end of each maintenance task, resulting in work having to be completed again at a considerable cost in

terms of readiness and efficiency. What has caused the Air Force to come to rely on inspectors for "quality"? What do the regulations say? Is there sufficient direction and guidance in the regulations to put the proper focus and emphasis on "quality" as the responsibility of the worker, not just the inspector?

Maintenance Quality Today

A review of USAF regulations and manuals which pertain to aircraft maintenance shows that, while we are making some progress, the guidance for "quality" work performance has changed very little since the 1960s. AFR 66-1, *Maintenance Policy*, today as then, stresses maintenance organization and elimination of nonessential, nonproductive procedures, and attempts to guide maintenance leaders to a balance between peacetime efficiencies and wartime requirements. While all these organizational requirements are valid, the requirement to perform at a "quality" peak is almost nonexistent. Performance of "quality" maintenance, or the mention of "quality," does not occur until paragraph 1-5 which says:

> Equipment readiness is the maintenance mission. Maintenance must keep Air Force equipment in serviceable condition, safely operable, and properly configured to meet mission needs.... In the long term, quality maintenance will prolong equipment service life and reduce defense costs. (1:5)

The primary focus of Chapter 1, AFR 66-1, is on serviceability, safety, and operability, and stresses that "maintenance personnel will identify changing needs in the areas of personnel (quality, quantity, and qualifications), equipment and subsystem technology (reliability, maintainability, and supportability)." Since AFR 66-1 establishes maintenance management policy for the Air Force and is the principal source document for the major commands to develop specific command-unique guidance on aircraft maintenance, it reasonably follows that emphasis on the requirement to perform "quality" maintenance should be upfront. It is not.

The second chapter of AFR 66-1 lays out specific responsibilities, by position, for producing maintenance. "Quality" is not mentioned at all as a responsibility for AF/LEY, the Director of Maintenance and Supply for the Air Force. AF/LEY is responsible for developing and publishing basic maintenance guidance. Equally as interesting is the failure to mention "quality" as a responsibility for the Wing Commander or his Deputy Commander for Maintenance (DCM). In fact, "quality" is not mentioned in Chapter 2 until paragraph 2-7A which says:

> The quality program will evaluate safety, personnel qualifications and performance, and equipment condition. The program will identify problem areas and underlying causes and recommend corrective actions.... The quality program should result in high efficiency maintenance production and equipment reliability. (2:11)

The traditional direction is on "quality" as an inspection program, not on "quality" as an integral part of each technician's daily responsibilities. Subparagraph (4) gets to the heart of it by stating, "All maintenance personnel are responsible for safety, quality, and reliability, and are accountable for their actions." (3:11) It is apparent that "quality" is not emphasized in the Air Force's primary maintenance guidance to the degree that industry highlights it and is an inspection program rather than a deliberate program designed to ingrain "quality" as a prerequisite for maintenance personnel at all levels.

What AFR 66-1 does emphasize are the organizational structure and responsibilities of the DCM's Quality Assurance division:

> The primary role of QA is to determine aircraft equipment condition and personnel proficiency including quality of training as directed by the DCM.... The majority of QA resources will be used to assess and compile condition summary reports to the DCM, on subjects specified by the DCM. (4:21)

This emphasis drives Air Force maintenance organizations to the quality inspection business at the wrong end of the maintenance process. Inspections occur after maintenance tasks have been performed, after the technicians have done their job, and after they have performed high "quality" or low "quality" work. In short, "quality" is a by-product of the current system, not the foundation of it.

Based on AFR 66-1, the major commands develop specific regulations tailored to each command's mission, aircraft types, and wartime responsibilities. As a result, Strategic Air Command (SAC), Military Airlift Command (MAC), Air Training Command (ATC), and the tactical air forces (TAF) have their own versions of 66-1. Each command's emphasis on "quality" maintenance is discussed in the following paragraphs.

MCR 66-5 (Multiple Command Regulation 66-5), *Combat Oriented Maintenance Organization*, is used by the TAF, which includes Alaskan Air Command, Air Force Reserve, Pacific Air Forces, Tactical Air Command, and United States Air Forces in Europe. MCR 66-5 decentralizes maintenance in an effort to form autonomous aircraft maintenance units (AMUs) capable of independent support for a fighter squadron, whether that squadron is operating at home base, or deployed. Decentralization is necessary in the TAF because many fighter squadrons deploy from home base to forward locations during times of increased tension or conflict. This mobility requirement causes tactical units to be autonomous and to demonstrate how they are organized in peacetime to fight in wartime. The first mention of "quality" in MCR 66-5 is in paragraph 1-3:

> ...Quality Assurance Program (QAP) goals include improving technician competence and the quality of maintenance. Improved maintenance is achieved by training the technician to use standard maintenance practices, by requiring compliance with technical data, and by periodically evaluating people and hardware.... (5:1-1)

As in AFR 66-1, MCR 66-5 has buried the requirement for "quality" maintenance. Paragraph 1-18 says, "Personal integrity and discipline are the cornerstones on which quality maintenance rests. Individuals are responsible and accountable for their actions." (6:1-5) The DCM and his key managers are responsible to "make sure that maintenance performed is timely and of high quality." (7:2-1) Finally, paragraph 4-1 says, "Quality maintenance is the responsibility of individual maintenance technicians, supervisors, and commanders." (8:4-1)

MACR 66-1, Volume I, *Maintenance Management Policy*, gives maintenance guidance to MAC units. MAC maintenance is centralized, reflecting an organization which remains at home base while MAC aircraft fly to en-route bases. MAC's maintenance policy says, "The key to mission success is the sustained ability to provide safe, reliable, and properly configured equipment at the time and place it is needed." (9:1) To achieve this, the DCM focuses on mission capable rates, time constraints, people and materials, unit resources, and limiting factors (LIMFACS):

> Quality is achieved by using the maintenance management system in this regulation and through a program set up to evaluate the quality of maintenance at unit level. The objective of the program is to improve technician competence and quality. The objective is realized by training the technician to use standard maintenance practices and strictly comply

with technical data and by periodically evaluating personnel and hardware with highly qualified technicians. (10:2)

MAC's focus is on following technical data and implies that quality maintenance will automatically result if technicians follow the book.

One positive aspect of MAC maintenance policy, like the TAF, is it focuses on the role that maintenance training plays in producing quality oriented technicians:

> Maintenance Training is an essential element in keeping and improving the equipment maintenance capability of the unit and is one of the most significant responsibilities assigned to maintenance managers and supervisors. (11:4)

This emphasis on training gets to the heart of this paper; training is the foundation in a maintenance person's development where "quality" must be emphasized and ingrained.

ATC maintenance is becoming unique in the Air Force as it is gradually being performed by commercial contractors rather than by blue suit Air Force technicians. ATC, like MAC, focuses on following the book, with "quality" as a result rather than as a process. ATCR 66-1, *Maintenance Management-Aircraft,* says, "Firm maintenance discipline and strong quality control programs are needed to ensure adherence to technical data and directives." (12:1) Supervisors have the primary responsibility for getting their people to perform quality maintenance. The ATC maintenance leaders interviewed by the authors are convinced commercial contract maintenance teams will provide "quality" work because their technicians will be experienced and highly skilled. Whether "quality" goals and standards will be part of the contractual requirements at each ATC base is still being negotiated by the command.

Of all the command regulations reviewed, SACR 66-9, Volume I, *Maintenance Management General Policy,* puts the most focus on "quality" at the very beginning of the regulation. Paragraph 1-3, "MAINTENANCE QUALITY," says:

> The objective is to improve technician competence and hardware quality. This objective is realized by training the technician to use standard maintenance practices and strictly comply with technical data, and by periodically evaluating personnel and hardware with highly qualified technicians. The successful combination of training and verification is necessary to meet command quality objectives. (13:1-1)

SAC also charges the DCM with responsibility for the wing-level "quality" program. The DCM will "ensure that a progressive training program is provided within the maintenance complex emphasizing quality training." (14:2-1) In Chapter 4, which covers the Quality Assurance function:

> Maintenance quality and reliability is the responsibility of all maintenance personnel. The combined efforts of quality assurance personnel, maintenance supervision, and technicians are necessary to ensure high quality maintenance production and equipment reliability. Maintenance supervisors are responsible for safety of flight, safety of equipment operation, and quality maintenance production. The Quality Assurance staff evaluates the quality of maintenance done in the maintenance organization, and performs the necessary functions to manage the organization's QA program. (15:4-1)

And finally, under SQUADRON MAINTENANCE, SACR 66-9 says, "The squadron's main objective is to perform quality maintenance to accomplish the mission." (16:1-2)

SAC guidance falls short, just as the rest of Air Force guidance on "quality," by spreading the responsibility to "everyone" in maintenance but failing to give technicians, supervisors, and DCMs a solid, organized, well-thought-out "quality" program. Too much emphasis is placed on inspecting work after it has been accomplished. This approach in effect relieves the worker/technician from responsibility once the QA inspector puts a stamp of approval on the work.

After reviewing the guidance in Air Force and Command maintenance regulations, representatives in each command headquarters were interviewed. These interviews were conducted by telephone to determine if there were any current initiatives underway to improve on or stimulate "quality" maintenance. In general, all those interviewed were concerned that maintenance technicians on today's flight lines are not aware of their ability to put "quality" into their work.

TAC personnel talked about the lack of adequate training new maintenance people receive as they go through technical training centers. The current training syllabi have evolved after years of pressure from the operating commands to shorten the time Air Training Command has with new airmen. Courses in the training centers are now so condensed that very little basic maintenance is taught in formal schools. The majority of practical maintenance skills are taught at wing level where apprentice technicians, called "three-levels," are enrolled in "maintenance qualification training and on-the-job training" immediately upon arrival. The challenge for these young technicians is immense, for they must learn about the Air Force and their new command and wing, and develop their own technical maintenance skills all under the pressures of a new place with new people. Too often, basic airmen are overwhelmed by all the responsibilities they have to face in their initial operational assignment. Unfortunately, efforts by wing maintenance training personnel and flight-line and shop supervisors to train new people are diluted by pressures to produce sorties in support of the wing's mission. As a result, training takes a backseat to production, and "quality" becomes an inspection that somebody else does, not the work an individual performs.

TAC is working with ATC on a new approach to do more and better training in the technical training centers. This ATC initiative is called "four-level" training and is designed to keep students at the technical schools for a longer time to give them in-depth courses in their specialties. TAC plans on the "four-levels" being trained sufficiently in their specialties to go to work right away after arriving at a new wing. TAC is also developing a formal "continuation training" program that will have time-phased training events throughout a technician's career. This new program is designed to move away from the current "on-the-job-training" program which is not effective because it relies on flight-line supervisors to act as instructors. Flight-line supervisors are often the most highly skilled technicians in a wing, but are primarily tasked with maintenance production and have little time to act as instructors.

MAC, like TAC, is focusing on maintenance training as a way to improve "quality" in the command. Maintenance personnel are convinced that training is the key to higher "quality" performance on the line and in the shops. But while TAC works with ATC to build a "four-level" training program, MAC is building a stronger wing training program. New technicians are assigned to the Maintenance Training Division for their first four months after arrival at a typical wing. During this four months, the technicians complete their "five-level" training and attend all base recurring training before going to the flight line. MAC leaders are concerned that the current system cheats technicians out of good training at the technical training centers by gradually reducing funding for ATC, thereby eliminating "quality" training. The ability to do the job right depends on "quality" training and the recognition that technicians have the

responsibility for producing "quality" maintenance every time they do a job.

ATC personnel, who were interviewed after hearing TAC and MAC concerns about training, said that ATC is attempting to pull training back to the technical training centers. They think the current system of sending PA inspectors to the line to inspect work relieves the technicians of responsibility and places the burden on the inspectors. ATC is convinced the first breakdown in "quality" occurs when the new "three-level" hits the flight line and the supervisor/trainer tells "how we do business here." ATC is counting on the Rivet Workforce program to improve the overall technical skills and "quality" of work performed by maintenance technicians in the future. Rivet Workforce is an Air Force program that will keep maintenance technicians dedicated to a specific weapon system type from the time they finish technical school until they reach the rank of senior master sergeant. This dedication should produce real expertise throughout the maintenance community.

In summary, research of the basic guidance for Air Force aircraft maintenance organizations shows a lack of focus on "quality." Air Force regulations do not provide enough direction for major commands or DCMs to develop meaningful, clear-cut programs. As a result, maintenance technicians do not have a strong sense of personal responsibility for doing "quality" work on each job and are not trained in techniques that will improve their performance.

Implementing Total Quality Management at the Flight-Line Level

Editors Note: *The TQM principles of Dr. W. Edwards Deming and Dr Joseph Juran were discussed in detail in Lt Col Michael Prowse's article, "TQM: A Leadership Revolution," in the Winter 1990 issue of the Journal. We encourage you to review that article to enhance your understanding of the following material.*

Deming's first principle is to "create constancy of purpose for improvement of product and service." DCMs can create that environment for improvement by establishing realistic, yet challenging, goals for their organizations. Examples are: Reduce repeat/recur rates by 10% over the next two years; lower the abort rate by 2% and maintain the new lower standard over a one-year period; meet all daily training sortie requirements with on-time taxi and takeoff times at a rate of 98%; reduce delayed discrepancies by 25% over the next 12 months; and win the command-level Daedalian trophy. These goals are not new or unusual. However, what is important is for DCMs to recognize they have the responsibility and the power to influence their organization's direction. Solid goals and high standards give an organization that direction. The old saying, "If you don't know where you are going, any road will do," is especially true for large organizations like a wing maintenance complex. The DCM and his squadron commanders must first create constancy of purpose in order for improvements in service to occur.

Deming's second principle is to "adopt the new philosophy" of accepting only quality work. Positive programs, including rewards for meeting and exceeding the goals established for an organization, can go a long way toward achieving this principle. Based on the authors' years of experience on Air Force flight lines, DCMs and squadron commanders too often focus on "negative" motivators in order to coerce their people to perform good work. Many old-school leaders labor under the perception that "fear" is the best motivator. If Deming and Juran are right, the negative motivators must be discarded to make way for positive reward and incentive programs. The "new philosophy" of positives can be ingrained in the organization by involving the work force and key supervisors in helping to establish common goals. For example, if the DCMs develop their goals in isolation from their commanders and the technicians who must carry them out, those goals will remain only theirs and their organization will attempt to accomplish them begrudgingly. To get an honest, dedicated effort toward surpassing unit goals, the DCMs must get people directly involved in developing those goals and standards. It really works. Both authors of this paper had the privilege of helping their maintenance organizations win either the command's or the Air Force Daedalian and Department of Defense Phoenix trophies for maintenance excellence. These awards represent the absolute top awards for aircraft maintenance and were achieved by individuals working together toward common goals. Those goals were established and accepted by all the people who then came to believe their efforts to perform "quality" maintenance in every task would help them win the top honors. In effect, they adopted the "new philosophy" as the daily standard for performance. That "new philosophy" permeated the maintenance complex and championship honors followed.

Deming's third principle says to "cease dependence on mass inspection." Early in this paper, we pointed out that most Air Force maintenance organizations do a lot of inspecting, with the belief that "quality" results from following technical data to the letter and has nothing to do with the technician's attitude toward the job. Inspections occur after the work has been performed. In organizations with the "new philosophy," most workers will be motivated to perform top-quality work every time, the first time. However, in many maintenance complexes, inspections have become indispensable because the inspectors find problems with almost every job. These organizations have come to rely on QA inspectors for "quality" at the wrong end of the maintenance process. DCMs must have the foresight, determination, and strength of character to create the atmosphere in their organizations that will allow them to reduce reliance on inspectors and inspections. One way to do this is to make the reduction of inspections one of the principal goals and one of the principal rewards for the people.

In industry, reduction of inspections is often used as a reward. At Lockheed, for example, work centers that typically produce error-free work are rewarded with fewer or no inspections. Their shops are marked off with a special paint of a different color from less effective shops as a means of identifying outstanding performance areas. This system serves to highlight the good and gives work centers that are performing at a lower level of "quality" something tangible at which to shoot. In 1989, General John Nowak, who was then Director of Maintenance for AFLC (now MAC/LG), and who was influenced by the quality guidelines initiated by General Alfred G. Hansen, who was then Commander of AFLC, told us his command had adopted this philosophy as a way to let the technicians know that their leaders trusted them to do "quality" work. He and his maintenance leaders and supervisors throughout the command improved their quality while relying less and less on designated quality inspectors. Some tasks performed in aircraft maintenance are considered critical to flying safety and, because of this criticality, are still inspected. However, instead of using QA inspectors, AFLC now uses other properly trained and experienced technicians to inspect the work of their coworkers. This approach gives workers a direct stake in the "quality" of their work, and it demonstrates the trust and confidence that

management has in the work force. One of AFLC's goals is to reduce designated "quality" inspectors to a minimum, relying instead on certified production workers to verify work in critical areas.

On operational Air Force flight lines, DCMs can improve "quality" by gradually weaning their organization of inspections. This is not a recommendation for doing away with all inspections. However, the reduction of inspections can be used as a reward, an incentive for maintenance people to shoot for. The better "quality" work that the people perform, the less QA should inspect them. In the long run, technicians in "new philosophy" maintenance units will perform to the highest standards of excellence because they will want to and because they feel responsible for the work they produce. They will reward the organization with top-quality work because they will appreciate their leaders' trust in them, and they will recognize that they have an important stake in the "quality" performance of their organization.

Deming's fourth principle, "End the practice of awarding business on price tag alone," does not apply as well to flight-line maintenance as it does to AFLC and Air Force Systems Command. The idea behind the words still has important meaning at wing level where the DCM can make critical decisions about how to direct peoples' efforts. DCMs must be careful not to focus all their attention on sortie production, or exercise and inspection preparation, at the expense of teaching people to perform "quality" maintenance. Ignoring "quality" is like making decisions based only on the low bid.

Next, Deming says to "improve constantly and forever the system of production and service." This goes back to goal setting, and his first principle, committing the people and the organization to excellence in all aspects of maintenance. The biggest hazard for any organization is to float along in mediocrity without a strong sense of purpose or direction. Such units have no goals. In some cases, these are yesterday's champions, organizations that sought and achieved high goals, and then, having achieved their goals, leveled out to mediocre standards of "quality." The key to "constantly improving" is to adjust organizational goals as the unit approaches them. One suggestion is that DCMs establish a small planning group, led by their assistants or key squadron commanders, to review progress toward those goals to which the organization is committed, and to develop new goals before the old goals are reached. This approach allows the unit to continue to improve; to continue to strive for higher "quality"; and, in this way, to achieve Deming's principle of constant improvement.

One of the best ways to constantly improve is to strongly implement Deming's sixth principle, which is to "institute training." "You only get one chance to make a first impression" is an old saying that is particularly true of Maintenance Training. Training is one of the first stops for people when they arrive at their new wing. As previously mentioned, MAC assigns new arrivals to Maintenance Training for the first four months, after which they are "trained" properly for their shop or flight-line duties. Maintenance Training is the ideal place for DCMs to focus on "quality," especially since it is the first impression of an organization for all the new people. Each maintenance training class should start with heavy emphasis on each individual's responsibility to perform top "quality" work on every task. The key is to teach new and old people the importance of doing the job correctly, with personal pride, and with a sense of ownership, the first time each technician works on a task. Training should show the people that there is no time to do the task over. Doing it right the first time requires a clear understanding and a personal commitment to "quality." That commitment can best be made with concentrated training from the very first time a new technician sets foot in the training classroom.

In addition to teaching technicians about "quality," leaders and supervisors must learn and be committed to "quality" and its importance in the accomplishment of unit goals. Most technicians perform to the level of their leaders' expectations. Simply put, to get a championship outfit, expect championship performances. Generally, people will produce commensurate with the level of demands. Demand "quality," and the people will produce "quality" providing they and their supervisors have been trained properly.

This fits perfectly with Deming's seventh principle, "institute leadership," because leadership sets the direction and pace in an organization. Commitment to "quality" is the most important factor upon which leaders focus. Juran makes "commitment to quality" a prerequisite for even working with companies who want to improve their productivity through better "quality." In the Air Force today, General Charles McDonald, AFLC Commander, and General Ronald Yates, AFSC Commander, have a commitment to "quality" and are working hard on training their leaders, supervisors, and maintenance technicians in "quality" principles and techniques. Their efforts, like those in industry, are designed to change the culture and work ethic in their commands so "quality" becomes the norm, not the exception. We are not naive enough to believe that changing the work habits and culture of an organization is a simple task. Real, long-term, lasting changes take a true leadership commitment from DCMs and their people.

Deming's eighth principle calls for driving out fear in people, fear of suggesting changes that will make maintenance processes better and more efficient. There are several programs today that encourage suggestions. We think these programs (MIP, CORE, product improvement program, and suggestion program) are sufficient, so there is no reason to reinvent the wheel. Review these programs to see if they are vital and meeting the organization's needs. Many times, the key to making these programs work is to put the right leader in charge of them. The leader creates a positive or a negative image for the program. The idea is to give people a stake in the organization through active participation in its improvement.

In addition to the standard Air Force suggestion programs, AFLC has instituted a new one as part of their "new philosophy." This program involves forming Process Action Teams (PAT). DCMs can use the same concept, focusing the efforts of these teams to review problem areas, or maintenance processes, and find better ways of doing business. QA inspectors can serve as team leaders to look into each process identified by the DCMs and their staff. Each team should be composed of flight-line and shop technicians in order to involve them in finding better ways to do the job. Their involvement helps make them part of the solution and will make suggestions easier to implement.

Formation of PAT teams will also help break down many barriers that may exist between the workers and the DCM staff. This is Deming's ninth principle and is a critical one since Maintenance Training and QA are two of the most important staff functions that have almost constant interface with flight-line technicians. Avoiding the "we/they" syndrome in large maintenance organizations is absolutely necessary to ensure success.

Next, Deming says to "eliminate slogans, exhortations, and targets for the work force." Eliminating slogans will be enthusiastically accepted by DCMs. They should periodically

go through the shops and see what kind of slogans, sayings, or bulletins accumulate and have them removed. Eliminating targets, however, may run against the grain of most DCMs. Many targets are set by the major commands in an effort to standardize. These targets serve as command goals over which wing-level people have little say. Deming's premise is to stop worrying about numbers and concentrate on making processes more efficient. For the DCM, try to eliminate programs like the old "Zero Defect" program and, instead, develop realistic work center goals and standards.

Next, "remove barriers to the pride of workmanship." This can be done by involving the people in all aspects of maintenance production including goal setting, PAT teams, recognition programs, and training syllabus development. The more involved people are, the more pride they will have in their organization and the more "quality" they will put into every job. Take away the inspection crutch and replace it with properly trained technicians who know the principles and values of performing top-quality maintenance, and the organization is on the way to being great.

The ideas of Deming, Juran, Hansen, and Nowak have been used successfully in industry and in AFLC to bring "quality" to the maintenance work place. These same ideas can be practically and thoughtfully applied to flight-line maintenance organizations in the Air Force today. It takes study, total commitment to "quality," and the dedication and leadership to make positive changes happen. By applying these principles, "quality" can be made a lasting process that will help keep the operational Air Force ready for tomorrow's challenges.

Headquarters Air Force and the major commands must also become directly involved in order for "quality" maintenance to become a permanent change in the basic "culture" of our Air Force. First, AFR 66-1 needs to be updated to include Total Quality Management concepts as directed by the Secretary of Defense in his policy statement on "quality." This basic 66-1 guidance to the major operational commands must set the tone for commitment to "quality," just like industry. Commitment needs to be on paper, in revised guidance to the field, and in the attitudes of senior Air Force logisticians. Their ability to convince maintenance leaders that "quality" is the best investment in excellence for any organization is key to the success of the program. "Quality" needs to be one of the first requirements listed in AFR 66-1, as a responsibility for every leader described in that regulation. In addition to updating regulations, Air Staff maintenance leaders should include "quality" at every professional gathering they attend. Their honest commitment to raising the overall production and performance of maintenance units in all the commands will set the stage for a gradual and permanent change in the way maintenance people view "quality." But writing regulations and talking about "quality" are only part of the actions needed at the Air Force level.

Long term "quality" in aircraft maintenance can be achieved only by properly teaching each technician the "quality" way to do the job. Training about "quality" must start in the technical schools and be included in each maintenance class. The technical training centers must teach their own instructors about "quality," perhaps hiring industry consultants to create an initial level of understanding concerning "quality" principles. Once the instructors know about "quality," they should begin revising course material so "quality" is a focus in each class taught in the training centers and in the Field Training Detachments worldwide. This focus on teaching and stressing "quality" from the very first will get new technicians started with a keen awareness of their responsibilities to perform top "quality" work on each task. They will also be taught to understand that "quality" work takes less time and energy over the long run than does sloppy work which must be repeated.

The major commands should revise their regulations in response to new Air Force guidance, with a special focus on putting "quality" up front in all maintenance directives. Ongoing efforts to work with Air Training Command to develop longer, more comprehensive maintenance training courses, with a special focus on "quality," should be continued. This effort, to develop "four-level" technicians, who come out of technical training with an in-depth knowledge of the maintenance skills required in their specialty, can pay long-term dividends to the Air Force. Properly trained technicians, with a clear understanding of "quality" and its benefits, can be made productive on the flight line much more quickly than today's lesser trained technicians. Like their Air Staff counterparts, major command maintenance leaders must be committed to "quality" maintenance production and become outspoken advocates. The major commands should encourage units to focus on "quality" by setting high standards, rewarding the best units with fewer inspections, and by reducing reliance on QA-generated statistical products. Guidance in command regulations can set the stage for DCMs to build "quality" training programs at the local level, using command-generated training models. "Quality" must be first in every command maintenance action.

This paper has presented some suggestions for DCMs, major commands, and the Air Staff to develop stronger "quality" programs throughout aircraft maintenance organizations in the Air Force. Now is the time to take full advantage of the solid work that people like Deming, Juran, and Hansen have done, in an effort to ingrain "quality" into the daily performance of each technician. The results of a strong "quality" orientation, from first training class to leadership on today's flight lines, will be safer, more efficient, and more timely maintenance production. Top-quality maintenance will be an important factor in offsetting the diminishing Defense budgets that began three years ago and are certain to continue in the near future as the United States attacks its immense federal deficit.

Recommendations

Our research leads us to the conclusion that "quality" initiatives being used in industry today can be applied on Air Force flight lines. The proven ideas of Deming, Juran, Crosby, and others form a basis from which to develop "quality" programs that will benefit the Air Force, while costing next to nothing.

We recommend the following actions be taken by the Air Staff:

(1) Establish a focal point in AF/LEYM to formulate comprehensive "quality" guidance.

(2) Review all guidance contained in AFR 66-1 series publications and bring "quality" to the forefront as a requirement at all levels of maintenance leadership in the Air Force.

(3) Initiate changes to AFR 66-1 so major commands can begin reviewing and improving their regulations in light of proven methods to improve the "quality" of maintenance.

(4) Conduct a thorough review of the initial maintenance training provided to recruits to ensure that "quality" principles are emphasized and taught in every class in every technical training center.

(5) Seek training in "quality" for all action officers assigned to AF/LEY, so they may better understand that "quality" principles can be learned, and those principles applied, when formulating maintenance policies for the Air Force.

We recommend the following actions be taken by each major command, pending Air Staff guidance:

(1) Establish a command focal point for developing "quality" programs within the command.

(2) Review, with Air Training Command, all initial courses being taught in the technical training centers and Field Training Detachments and make changes to emphasize "quality" training in each course.

(3) Provide interim guidance to the DCMs on "quality" initiatives to improve local maintenance training courses, with special emphasis on "individual technician" responsibilities for performing "quality" work on each job.

(4) Review command standards and QA inspection guidance in an effort to reduce reliance on inspecting-in "quality" and increase reliance on building-in "quality."

(5) Review command Inspector General and Maintenance Standardization team guidance, emphasizing "quality" performance by technicians rather than QA programs as a means of assessing each unit's "quality."

(6) Reduce the number of command-level inspections performed on units which historically meet or exceed standards. Less inspection is a tangible reward for superior maintenance performance.

(7) Turn Air Staff guidance into positive changes in command maintenance regulations.

We recommend the following "quality" checklist for DCMs, based on principles used by Deming and others:

(1) Recognize that leadership sets the standards for the organization.

(2) Involve the workers in developing unit goals.

(3) Accept only "quality" work. Don't walk by a malpractice.

(4) Reward excellence with positive programs, like the TAF "UTE Day" program.

(5) Reduce inspections. Put those experts back to work on the line.

(6) Focus on constantly improving the organization by periodically updating goals.

(7) Teach "quality" in every training class.

(8) Expect excellence from your people.

(9) Encourage new ideas and solving problems through Process Action Teams and existing suggestion programs.

(10) Eliminate meaningless slogans.

(11) Instill a "sense of ownership" and a "pride of workmanship" throughout the organization.

(12) Become a "quality" zealot.

Adoption of these recommendations will help move the Air Force and its maintenance organizations toward higher "quality" workmanship and, as a result, better equipment performance. Joining the "Quality Revolution" is a must if we are to improve the combat capabilities of Air Force weapon systems as we enter the next decade.

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Big Changes Ahead for Air Force Now

Air Force Now premiers in its new format this October. The hosted, fast-paced 15-minute program will bring audiences up-to-date news and information, as well as public service messages and feature stories from throughout the world.

Also beginning in October, Air Force Now will be distributed only in 8mm and VHS videotape. Commanders need to work with base Visual Information libraries to ensure the proper video projection equipment is available to show Air Force Now to large audiences.

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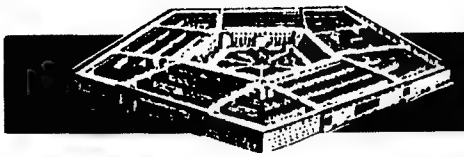

USAF Logistics Policy Insight

Revisions to MIL-S-7742 and MIL-S-8879

The Department of Defense is preparing to issue revisions to two specifications (MIL-S-7742 and MIL-S-8879) that will get down to the nuts and bolts of things. They specify the dimensions, geometry, and tolerances of the threaded portions of all Class 3 screw threaded products, from turbine shafts to nuts and bolts. While the engineering dimensions will not change from those in the current specs, we will require more meaningful verifications to ensure the threaded product conforms to the spec requirements. Current inspection criteria can pass noncompliant material. The revisions will also establish a "Safety Critical" category for those threaded products where a single failure of a threaded item can cause loss of the system or injury to its operators. Those threads will have all their critical dimensions verified. Two years ago the Air Force issued draft specs to cover Air Force procurements that contained the same provisions as the proposed revisions. The new specs will cover all DOD procurements. The new verification policy will ensure the military services receive a dimensionally conforming quality product that not only GOES together but also STAYS together. (Lt Col Nick Hablenko, SAF/AQXE, AUTOVON 227-2875)

Authorization and Procurement of Weapons

Beginning with FY 1971, Congress required specific quantitative authorization of weapons prior to procurement. This authorization is part of the annual congressional authorization and appropriation cycle or may be obtained through a formal reprogramming request. The term "weapons" is defined as all handguns, rifles, mortars, machine guns, artillery pieces, crew served weapons, and weapons using fixed ammunition regardless of intended purpose. This requirement is stated in 10 US Code, section 114. Therefore, procurement of weapons, including local purchase (see AFM 67-1, *Basic Air Force Supply Procedures*, Vol I, Part One, Chapter 8), by any Air Force agency using appropriated funds and without express authorization by Congress is a violation of law. Since procurement requires congressional authorization, requirements must be included in the President's Budget. To be included in the President's Budget, requirements must be made known to the Air Force Logistics Command prior to the annual Buy/Budget review conducted each summer. Requirements should be identified in sufficient time to consider budget and procurement leadtime. While the process is long and complex, it is the only means of buying weapons with appropriated funds. Requests or procurement of weapons with appropriated funds without prior congressional approval is not possible within the law. (Mr Frank Jones, AF/LEXP, AUTOVON 227-3119)

Implementation of DMRD 901, Reducing Supply System Costs

The ongoing Defense Management Review has directed fundamental changes in Air Force logistics. One of the first, Defense Management Report Decision (DMRD) 901, will affect all maintenance and supply activities.

The principal impact of the DMRD is to change the financing for DOD depot inventory control and distribution functions from wholesale Operations and Maintenance (O&M) accounts to Service stock funds. The costs will then be passed to stock fund customers through surcharges on sales. The specific functions to be transferred are being identified in conjunction with a DOD-wide effort to implement a "cost per output" resource management system. The DMRD also included other initiatives to transfer activities to the Stock Fund and streamline logistics operations.

A related decision, DMRD 904, Stock Funding of Reparables, directed the Services to transfer depot level repairable (DLR) spares and the cost for depot repair of DLRs from appropriated funding to the Service stock funds. Costs for the DLRs and their repair will also be paid by customers through stock fund prices.

Two new Air Force Stock Fund (AFSF) divisions will be activated in FY91 to manage the new activities: the Cost of Operations Division (COD) and Repairable Support Division (RSD).

Once the changes are implemented, the COD will pay manpower and all other direct costs for depot management of stock fund items, including payrolls for item managers and warehousing and materials handling personnel; travel; supplies and equipment; and miscellaneous contractual services. The COD will then allocate the costs to the other AFSF divisions.

Customers of the AFSF will note a growing impact from the changes. In FY91, prices for the General Support Division (GSD) and other divisions which buy from the Defense Logistics Agency (DLA) will increase as a result of higher DLA surcharges. Prices for the Systems Support Division (SSD) will remain relatively stable in FY91—and then increase in FY92—because Air Force overhead costs will be paid by direct appropriation to the Stock Fund during the first year of implementation. RSD customers will continue to receive DLRs "free" for two years, since costs will be paid by the direct appropriation in FY91 and by a centrally managed O&M account in FY92. Not until FY93 will base and depot customers pay for RSD issues and overhead costs.

Funding for this customer budget increase has already been programmed within O&M and related appropriations (less a reduction for expected savings from DMRD 901/904 improvements). Budget requests for this funding will be set forth in two places: as proposed surcharges in Stock Fund Operating Program requests and, to pay the surcharges, as supply and equipment requirements in customer O&M budgets. As the cost per output management system is implemented, the surcharge funding levels will be tied directly to workload, with unit cost measures used to assess requirements.

Implementation of DMRDs 901 and 904 will be a challenge but will pay big dividends in the flexibility given to unit commanders, the direct link established between logistics funding and the mission capability of the activities which consume the resources, and the efficiencies gained by applying the unit cost per output approach to stock fund activities. (Mr Steans, HQ USAF/LEXW, AUTOVON 225-2897)

Combat Air Base Performance Planning Principles

The Air Force has developed and validated planning principles for combat air bases. The planning document is

designed to respond to new concepts of force projection and can be applied to varying situations. The timeless principles include redundancy; flexibility; adaptability; reliability and maintainability; interoperability; accessibility; sustainability; warning, assessment, and control; plan for people; protection of resources; combat siting; and balance. These principles will help answer the question, "How does one determine where to locate a base and what facilities and functions will be needed and where should they be sited to best perform the mission?" They were validated by active duty and retired flag and senior officers from cross Air Force functional lines at a symposium at the Air Force Academy. The planning document should be published in September 1990. (Mr Charles F. Lewis, AF/LEEDX, AUTOVON 297-6242)

New MILCON Delivery System

Engineering and Services has developed a new MILCON delivery system that focuses on customer involvement in the project development from the initial planning effort to completion of construction. Under the new process, the designer develops the design concept before detailed design begins. After interviewing the affected base agencies, the using MAJCOM representatives, and the Base Civil Engineer, the designer will brief the concept design to all affected groups and gain consensus on the design requirements prior to proceeding with design. While this review will not be the last opportunity to influence the design, it is expected to reduce the number of "surprises" encountered in design reviews. (Mr David Nichols, AF/LEEDP, AUTOVON 297-4156)

Management and Equipment Evaluation Program

Have you ever found a new commercial vehicle, tool, or piece of equipment that would enable you to do your job faster, better, or more economically, but it was not available in the table of allowance (TA)? Today you can stop waiting and help yourself and other CE personnel under the newly revitalized Management and Equipment Evaluation Program (MEEP) at HQ AFESC. The MEEP is covered by AFR 77-5, *Management and Equipment Evaluation Program (MEEP)*, and is designed to help us acquire and test new commercial vehicles, tools, and equipment. The program operates under the "try before you buy" concept. Anyone within civil engineering can submit proposed projects to HQ AFESC/DEMG through the MAJCOM MEEP manager. Upon receipt of the submittal, HQ AFESC will work with HQ AFSC to contact the proposed manufacturers to find their willingness to participate in the MEEP program. (SMSgt John Pugh, HQ AFESC/DEMGR, AUTOVON 523-6400)

Support of USSOUTHCOM

The Air Force Engineering and Services Center Directorate of Readiness (HQ AFESC/DEO) is fully committed to supporting Air Force requirements in the USSOUTHCOM theater. As Air Force manager of the Prime BEEF, Prime RIBS, and RED HORSE programs, as well as overall operational planner for Engineering and Services support of theater war plans, DEO has been working closely with USSOUTHAF/DE, the focal point for USSOUTHAF engineering requirements. The USSOUTHCOM AOR provides many unique opportunities for direct Engineering and Services involvement in our national strategy of stability through nation and institution building programs. It also presents an excellent opportunity to improve upon and exercise our wartime engineering and services capabilities. DEO will continue to work with USSOUTHAF planners to assist with both near-term and long-range regional planning objectives. (Capt Parker, HQ AFESC/DEOP, AUTOVON 523-6144)

Standardized HVAC Control Systems

The Air Force has implemented the Army standardized heating, ventilating, and air conditioning (HVAC) control system by superseding the current Engineering Technical Letter (ETL) 83-1, Change No. 1. The new specification and technical manual is a follow-on development of the standardized HVAC control panel concept developed for the ETL. Extensive commissioning and more diagnostic features were incorporated into the new HVAC control system panels. The system will be based on standard control systems, strategies, and sequences of operation. Standard and interchangeable control components will be used. The standardized HVAC control system will allow technicians to become familiar with the same type systems in facilities worldwide. (Mr Jerry D. Williams, AF/LEEDE, AUTOVON 297-6237)

Survivable Airbase Utility Handbook

The *Handbook of Design Criteria and Considerations for Survivable Airbase Utilities* has been developed by AF/LEEDE in conjunction with the New Mexico Engineering Research Institute (NMERI) and was distributed during July 1990. Numerous scientists and engineers from the engineering and services organizations of all the major commands contributed to the technical content of the handbook. It provides recommended criteria to protect against three attack scenarios: air attack via aircraft or theater ballistic missiles; ground forces or commandos (Spetsnaz); and attack by terrorists. The handbook is applicable to conventional warfare and those installations which may be subjected to one or more of the above three attack scenarios. (Neil Rochelle, AF/LEEDE, AUTOVON 297-6237)

MWR Construction Policy

On 21 August 1989, the Deputy Assistant Secretary for Installations issued major policy changes to the Morale, Welfare, and Recreation (MWR) construction program. Reduced MAJCOM repair approval authority requires SAF/MII approval for repair or renovation projects on an MWR facility (for which NAF is the fund source for construction) if cost exceeds $500,000. Separate contract accounting is required for the combined O&M repair and NAF construction efforts to include separate work schedules and separate categories of work on contract drawings. Full disclosure is required for NAF construction projects. Project documents will identify any repair or construction project done in conjunction with or in the vicinity of a NAF construction project. (Ginny Herrington, AF/LEEPO, AUTOVON 227-8902/8957)

(NOTE: In the Spring issue, the OPR for "New Centralized Integrated Diagnostics Office" should have been Major Alphronzo Moseley, AF/LEYM, 227-6319.)

Integer of Logistics: A Productivity and Quality of Work Life Initiative

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Introduction

This paper examines an 11-year organizational change effort at the McClellan Air Force Base Air Logistics Center (ALC). The underlying motives for the change were to improve the quality of work life and increase worker productivity. What makes this effort so unique is that it took place in a most unlikely environment. While the Air Force has a well-earned reputation for innovation and creativeness in its approach to management, few would have expected a change effort of this magnitude and duration in a highly structured organization like the Air Force Logistics Command (AFLC). Fewer still would have given it much chance of success. Such a change effort would be much more characteristic of Air Force Systems Command (AFSC). AFSC consistently faces a more dynamic and rapidly changing environment in the research and development arena and, in fact, did implement a similar matrix management approach at approximately the same time. (14:16-21)

McClellan AFB is the largest employer in Northern California. When this effort began, there were more than 17,000 civil service and military personnel employed. It is a major industrial site charged with management responsibility and repair of assigned Air Force systems. The initial impetus for the change was in response to changing technology with its concurrent effects on personnel, productivity, and organizational structure.

Background

In the early 1970s, the Air Force reorganized its depot repair functions by centralizing technologies at various ALCs. This move was prompted by budgetary concerns and was an attempt to eliminate costly duplication of expensive specialized labor skills and equipment at the five major depot locations. Repair responsibility for designated technologies was thus transferred and centralized at specific ALCs. Inventory management responsibility, however, remained decentralized across all ALCs with the systems that used the individual technologies. Significant communication and coordination problems resulted between inventory managers and repair centers. The problem was further exacerbated by the increasing technological complexity of the systems and items involved. (9:20)

At the time, each ALC was organized into four standardized mission directorates that were functional in orientation. This existing functional structure was causing some of the problems generally attributed to that organizational form; i.e., tunnel vision within the functional areas, competition between functions, coordination difficulties, slowed interfunctional decision making, and loss of top management visibility over the overall operation. (13:16-17)

In 1974, changes occurred in the command structure at Sacramento ALC. The newly arrived top level managers determined that cumbersome communications existed between key functional areas, decision making was at too high an organizational level and without a corporate perspective, and a lack of long-range planning existed. (9:23-24)

What appeared necessary was a systemic approach that considered the situation in its entirety and examined both task and human inputs in designing a basic structure to correct these problems. (1:4) The matrix organization was the logical candidate, and some form of matrix was warranted because it is a hybrid form which contains characteristics of both product and functional structures, and jointly allocates responsibility to the heads of each. (6:59;13:394) In essence, it provides a product orientation and focus that emphasizes a horizontal view across the organizational units providing support rather than a vertical one up and down the functional hierarchy. This is how the repair process operates.

The hierarchical management organization found in a functional structure cannot cope with high complexity and a high information processing volume. (13:71) Sacramento ALC at that time was experiencing several trends which favored a product orientation. For example, there were rapidly changing systems and technologies; increasing interdependencies among functional areas; situations requiring diverse technical expertise to be closely and quickly coordinated; unique, nonrepetitive tasks to be accomplished; and an increased need for responsiveness to the operational commands. (4:78-79;5:42)

Another idea called integer was combined with the matrix. The integer concept was to form an organizational structure around an integer or "whole" that encompassed all the resources needed to complete a given job from beginning to end within one organizational unit. Muller-Thym, the originator, perceived that the reintegration of a number of tasks into one complete work unit would improve group efficiency because the members could see the relationship among themselves and the total job to be done. (8:24-43)

The resulting program was a combination of the integer and matrix concepts. The initial program was entitled *Integer of Logistics* and implementation was in four phases. Phase I was a pilot program in 1975. Phase II was the first actual implementation with five product teams in the Communications-Electronics Division of the Materiel Management Directorate in 1976. Phase III was the formation of seven more teams in the Item Management Division of Materiel Management in 1979. Finally, the last step was the establishment of "small companies" in both these divisions in 1986 when the concept was legitimized and became part of the formal organizational structure. At that point, integer as a program ended.

Integer of Logistics

Pilot Implementation (Phase I)

As with any change, there were problems to solve. The existing organizational culture can often scrub in a negative way to block effective problem solutions. (11:66) AFLC required a standard functional organizational structure throughout the ALCs which meant that limitations had to be placed on the

matrix's authority. The Sacramento ALC Commander authorized the program to attain the following objectives:

(1) To facilitate the logistics process by focusing on the task to be performed and grouping the functional skills around it.

(2) To foster a corporate viewpoint in problem analysis and decision making.

(3) To reduce operating costs by better using personnel and nonhuman resources.

(4) To improve the using commands' (customer) logistic support. (9:26)

A lead division approach was used during implementation. This is a recognized alternative to an all-out project organization matrix because it vests in the lead division the responsibility to coordinate, but it severely limits its authority to direct the activities of other affected divisions. (13:19) However, this approach maintained the standardized functional structure that AFLC wanted at all ALCs: intact and operational with Materiel Management as lead division.

This structural choice necessitated the designation of a coordinator who could keep top management informed; however, the coordinator was given no formal authority to direct action from team members. The composition of the typical integer team consisted of 12 to 15 members depending on the item involved. They were drawn from all four of the ALC mission directorates involved with the particular product. The team coordinator came from the lead division. The pilot teams operated under the following ground rules: (9:28-29)

(1) The existing organizational structure and formal appraisal system would remain unchanged.

(2) No authority was granted to the teams other than formal recognition.

(3) Team members were encouraged to communicate face-to-face with other team members horizontally across functional lines.

(4) Team members were selected based on current job assignment rather than "loading" the teams with the best functional specialists. This was done to guarantee fair tests and to ensure members were "typical" employees.

(5) Funding for teams was based on past management policies with no additional funds provided.

(6) Teams were allowed to select their own management indicators by which to determine their effectiveness.

The decision to introduce a modified project management matrix in any organization is difficult because what it really entails is a power balance between functional department managers and coordinators each with a different set of goals. (3:163) The matrix means more and more responsibility is being taken at lower levels. Theoretically, this should result not only in better decisions, but also in greater involvement by individual team members which necessarily leads to more commitment to team goals and objectives. (2:120) Thus, the more organic, participatory, and human relations oriented the management style, the more this new ideology succeeds at the organization's operating levels. (7:497) Many of these characteristics are exactly what advocates of quality of work life issues seek to instill within the organization.

The ALC Commander requested an evaluation of the program after approximately one year. Overall, it was judged to be a success, but several problems were highlighted. The coordinator was lower in grade than some team members; members were unable to provide quick answers to highly technical issues due to lack of expertise; and, in some cases, members were not authorized by their functional supervisors to commit their functions to action. This impeded team responsiveness. Finally, there was also some structural misalignment between units that further exacerbated the problems encountered during the pilot effort.

The most impressive pilot program accomplishments were the lowering of the decision-making level, the institution of a systemic advocate for the product across the ALC, and significantly improved lateral communications among the functional areas involved in the repair process. The integer team served as a mechanism that enabled team members to interact formally on a regular basis with those individuals who had a direct impact on their ability to do their job successfully. The daily interaction and face-to-face communication allowed individuals to see how their decisions affected the total logistics process, and to recognize, in many cases for the first time, how their function fit in with the overall logistics process.

Widespread Implementation (Phases II and III)

From 1976 through 1986, the integer program was in full force. First, the Communications-Electronics Division's workload was organized around "integers of work," and then the Item Management Division's workload followed in 1979. The author was involved in planning the Item Management conversion, acting as a coordinator for an integer team, and administering the overall program during part of this period while assigned to McClellan. There was a great deal of similarity in the planning and implementation of the integer concept and matrix organization within these two divisions, so they will be discussed concurrently. Although, in truth, many of the lessons learned in the Phase II effort eased the conversion in Phase III.

The interdependence pattern that had been used as the basis for determining pilot team composition was continued into Phases II and III because it is a key to successful implementation. (3:53) The focus also remained on the team coordinator's role as system integrator with the prime function of coordinating the efforts of various functional group representative so the goals of the team are met and the ALC's customer in the field is satisfied. (12:56) When even a modified form such as the integer matrix is adopted, its purpose is to provide concentrated management attention on the complex and unfamiliar effort that a product focus requires. At the same time, however, it must perfect the remainder of the organization to proceed with routine business while the matrix functions. (10:173) This is much more easily said than done.

With widespread implementation came some significant developments. The first of these was the use of team building workshops to develop cohesiveness, loyalty, and understanding among members. Workshop participants described their job responsibility and outlined what they intended to do for the team. Other members used questions to clarify functional interrelationships and specify what they thought the member's commitment should be. What resulted by consensus was a verbal contract on the duties and responsibilities of each member. This broadened the functional member's perspective and permitted a better understanding of where one's job fell in the overall scheme of things.

The second significant development was a partial co-location of some team members. The coordinator, item managers, product managers, engineers, and equipment specialists from within the Materiel Management area were pulled out of their functional units and physically co-located in the same work area. Many functional managers who were less than enthusiastic about the role conflict between themselves and the coordinator were further threatened by having subordinates moved out from under

their direct supervision. Team members affected by this action however were quite positive about its benefits.

The final development was the formalization of specific coordinator/team authorities. Most important was that the team was empowered to decide which projects it would work on. It established its own priorities. Additionally, the team scheduled its own meetings; tasked its individual members; established its own schedules; and, through the coordinator, had immediate access to any organizational level necessary to get a problem resolved. There was also a formal requirement for at least a quarterly briefing on progress and problems to the highest organizational level. Most team members were most enthusiastic about what these authorities meant in terms of control over their job, accomplishments, and a sense of participation in decision making.

Establishment of Small Companies

The final phase occurred in 1986 with the institutionalization of what up until then had not been part of the formal organizational structure. With AFLC removal of the requirement for a standard functional structure common to all ALCs, McClellan was free to revamp its structure to reflect the reality of the integer teams. Functional supervisors at the GM-13 level were assigned to replace the coordinators as heads of the small co-located companies. Integer teams were thus incorporated into the formal organization, and team leaders were the high-graded former functional managers who now supervised the complete array of skills and functional specialties within the Materiel Management area. Integer as a program had ended.

The change effort had come full circle. What had originally been an informal arrangement, blessed only by the legitimacy of recognition and constrained by all sorts of restrictions, now moved to center stage as the recognized and legitimate structure. These small companies were designed to focus on work and the worker, built on the integer of work concept, aligned to the natural work flow across functional specialties, and keyed to specific technologies. Thus, although the program had ended, the idea of its legacy lived on in the formal organization.

Conclusions

It is difficult to definitively analyze and discuss the results of this 11-year effort because management was unsuccessful in their attempts to develop objective measures of productivity improvement and could not survey the participants in the program for fear of violating civilian personnel regulations. However, some conclusions are still possible:

(1) Lateral communications were improved. The program formalized and legitimized what effective workers had done for years. That is, communication across functional lines rather than up and down the respective functional chains became the norm.

(2) Decision making was delegated to lower functional levels within the organization. Team members felt an increased control over their jobs and had a direct input into the decision process.

(3) There was a reduction in bureaucracy both in terms of levels and formalized rules. The teams had more power and control vested in them as the integer program continued.

(4) Team members' satisfaction grew as a result of their increased influence, control of work assignments, and great input to the decision-making processes.

(5) The change created a single point of responsibility for the product across the entire ALC. Someone was now responsible for the entire product, all functional interfaces, and the integration of all product efforts. This had never existed before below the level of the commander.

(6) Over the 19-year time frame, the number of items managed increased, the support levels improved, and the number of people employed at the ALC decreased. This would indicate that people had become more productive because fewer employees were providing better support for a larger number of more technically sophisticated items than when the program was first instituted. Overall the author feels that the program was a success, and its institutionalization seems to substantiate that assessment.

Epilogue

Changes are still occurring three years after the "small companies" concept was implemented and became part of the formal organizational structure. The changes, however, represent more a refinement than a decrease in commitment to the underlying concept of emphasizing system and process over function. Some of the changes are:

(1) AFLC instituted Process Action Teams (PAT) across all ALCs concerned with productivity issues and composed of members from varying functional areas.

(2) The small companies still function unchanged in the communications-electronics area. However, in the Item Management area, many items have been transferred to the F-111 and A-10 divisions to give the system managers more control over the processes that affect their systems.

(3) Procurement personnel have begun to be physically collocated in the Materiel Management (MM) area with MM personnel working on the system/items for which they buy. Movement is contingent upon how rapidly space can be made available and remodeled.

The concept has been institutionalized to such an extent that AFLC is now extending the concept to its other ALCs.

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CAREER AND PERSONNEL INFORMATION

Civilian Career Management

Training

a. The CCPO provides a computer-generated Career Enhancement Plan (CEP) during the Annual Civilian Training Survey, normally the March-June time frame. Personnel should have already entered their requirements for LCCEP-sponsored training on their CEP to be considered for FY91 training opportunities.

b. Professional Military Education (PME)—Squadron Officer School, Air Command and Staff College, Air War College—and the Executive Leadership Development Program are available through centralized funding sources. Individuals may indicate their interest in these programs through a solicited nomination process. Additionally, they are encouraged to participate in PME through seminar or correspondence. Logistics managers are moving into a new role, and individuals should make every effort to get the kind of training, such as PME, that can enhance their advancement into a leadership role. Interested personnel should visit the base education office soon to investigate training through a seminar or correspondence.

AFIT Selections

The following civilians were selected for the Graduate Logistics Management Program at AFIT:

a. Mr William J. Allen, GS-12
b. Ms Marlies DeWoody, GS-11
c. Ms Linda K. Dow, GS-13
d. Mr David E. Gressman, GS-12
e. Mr Shawn P. Lyman, GS-12
f. Mr Paul J. Lyons, GS-13

Cadre Notes

a. Cadre interviews for the current cycle (Cycle X) have been completed. There were over 1,700 interviews with 598 selections for Cadre.

b. All LCCEP registrants who want to be considered for the Cadre must apply by filling in "Block 8" of AF Form 2675, "Registration and Geographic Availability," and submitting it to their servicing civilian personnel office (CPO). If there are any doubts, contact the customer service in the CPO for verification application status. Submit the Cadre application by 15 September 1990 to ensure consideration in the next cycle.

Logistics Professional Development

Logistics Officer Professional Development (LOPD) Program

Logistics officers now have an opportunity to increase their depth of logistics knowledge under the Logistics Officer Professional Development (LOPD) Program which was adopted at last year's logistics Board of Advisors (BOA) meeting. The BOA advises the Deputy Chief of Staff for Logistics and Engineering (AF/LE) on a variety of issues ranging from new and existing weapon systems to personnel and training. The MAJCOM Deputy Chiefs of Staff for Logistics (LGs) play a major role in the makeup of this board.

The purpose of LOPD is to assist in the professional development of logistics officers. The first aspect of LOPD is the MAJCOM LGs' review of the progress of their officers as they reach the end of the initial and intermediate phase points, and the middle of the advanced phase points as outlined in AFR 36-23, *Officer Professional Development*, Chapters 20, 21, 24, 26, and 28. This review will be conducted as officers complete five years of commissioned service and after they have met the major and lieutenant colonel boards. During each of these reviews, the MAJCOM LGs have the opportunity to see where their logistics officers rate in duty history, performance, and professional development. The LGs will make recommendations on the professional development of each officer to HQ AFMPC, the officer, and the officer's commander. The second aspect of LOPD will allow officers who have completed five years of commissioned service to crossflow into another logistics career field for one tour. The LGs will make their recommendations for crossflow from those officers involved in the initial phase point review. The number of crossflows will be small compared to the number reviewed. Technical training will be provided. The intent of the program is to add to the officers' depth of knowledge in logistics after they have completed at least five years in the primary logistics AFSC. This extra depth will enhance their job performance as they assume senior field grade logistics positions.

MAJCOMs conducted their reviews during the July and August time frames; 1985 commissioned date officers were considered, along with those officers who were selected by the most recent major and lieutenant colonel boards. The annual reviews will be conducted during the summer months. LOPD will be managed at MAJCOM level, with HQ AFMPC providing assistance and implementation of recommendations. Officers and their commanders have an active voice in LOPD through the AF Form 90. Officers should update their AF Form 90, and MAJCOM recommendations must be matched to Air Force requirements. LOPD reorganizes the interdependence of the various logistics career fields and could be a big step forward in producing the kind of logistician needed in higher headquarters planning, programming, and policy positions.

(Lt Col G. B. Vega, Chief, Logistics Officer Assignments Branch, HQ AFMPC/DPMRSL, AUTOVON 487-3873)

READER EXCHANGE

Rx

Dear Editor:

Lt Col Cook's article (Spring 1990 issue) "Making Sense of Spare Parts Procurement" was right on the money. He mentioned that "the Air Force now discourages equal distribution of support costs among line items of disparate value...."

Aside from the horror stories, which are bad enough, such practices can lead to higher costs. First the $4 screwdriver appears on the record as costing $254, through line item allocation of overheads. Later, the next buyer thinks he is getting a great bargain when he purchases the same screwdriver for $20.

The first rule of good business practice is "know thy costs." Line item allocation of overhead masks real costs. The practice should be prohibited. Rather, overheads should be allocated in proportion to the costs of the items, when no better method is available.

Larry Briskin
Operations Research Analyst, ASD
Wright-Patterson AFB, Ohio

Blue-Two Number One with Air Force and Contractors

Wiping the hydraulic fluid off his hands, Bill Roeseler steps back from under the wing of an F-15 Eagle to examine his work. He's performing a task every airman does when replacing the strut seals on a fighter jet.

But he is no ordinary maintenance technician.

As a structural analyst for United Technologies' Advanced Systems Division, Roeseler is getting his hands dirty, spending a week learning what it's like to work in "the real Air Force."

This unique experience is part of the Blue Two Visit program managed by Air Force Logistics Command. Named after the Air Force's blue-suited two stripers, visits allow contractors to work side by side with airmen on base flight lines worldwide, gaining a better understanding of how the systems they design perform in operational conditions. . . .

Since the Air Force started the program in 1983, more than 960 contractors have received the special orientation.

During a typical five-day visit, the team visits four major commands at different locations. Each day is spent accomplishing a variety of maintenance tasks under the oversight of knowledgeable airmen.

"It was a real eye-opener for me," said Roeseler, who participated in a visit to bases in Alaska last winter. "Since my Blue Two Visit, I now identify with the maintainers—with their day-to-day problems. I can redouble my efforts, with greatly improved insight, to deliver defense systems that are highly maintainable."

Captain Mary Parker, manager of the Blue Two program, said the visits are beneficial. "Blue Two is smart business, not just for the contractor but also for the Air Force." She said the reliability and maintainability of current and future weapon systems benefit from these types of visits.

"The design engineers get to talk to the airmen who make their system work, and those who repair it when it doesn't," said Parker, who works for AFLC's Acquisition Logistics Division deputy for Technology Applications. "They take those lessons learned back to the drawing board when they're designing new systems."

One example of an improvement in R&M involves the Advanced Tactical Fighter (ATF). A design engineer from an engine manufacturing company went to Eglin AFB, Florida, during a recent visit to see some of the maintenance difficulties faced by maintainers before completing his component design for the ATF engine.

After unsuccessfully attempting to remove and replace some inaccessible engine components, the engineer went back to the drawing board to redesign his portion of the ATF engine. He relocated other parts of the engine so all the components would be easy to reach when the engine bay doors were opened.

Military and civilian employees involved in government research and acquisition can also take a part in Blue Two visits. In the past seven years, more than 530 Department of Defense participants have taken on the role of maintenance technician. National Laboratory and university members have also been involved.

AFLC *News Release*
July 3, 1990

Graduate Management Programs

Graduate programs offered by the School of Systems and Logistics provide selected military and civilian managers with an educational experience designed to enhance their ability to effectively analyze, design, and manage complex defense systems developed to meet USAF needs. Students major in either engineering management (GEM), logistics management (GLM), contracting management (GCM), acquisition logistics (GAL), cost analysis (GCA), systems management (GSM), information management (GIR), or software management (GSS). The GLM program is further delineated into options in logistics (GLM), supply (GIM), maintenance (GMM), and transportation (GTM). Figures 1 and 2 show the historical composition of AFIT classes by major. Each program has been developed to enhance the student's ability to accomplish the following educational objectives:

(1) Apply systems theory to the analysis of complex phenomena, problems, and decision situations.
(2) Conduct and report scientific research in the process of solving problems and making decisions.
(3) Apply descriptive and inferential statistics to problem analysis.
(4) Use operations research concepts and techniques to improve problem analysis and decision making.
(5) Use effective oral and written communication skills.
(6) Apply concepts and techniques of organization and management theory and organizational behavior.
(7) Apply computer programming and higher level computer based applications.
(8) Apply concepts and techniques of economic analysis, financial management, and accounting in acquiring and controlling resources.
(9) Apply concepts and techniques of providing goods and services (contracting, production, distribution) to support the operations of complex organizations.

Eligibility requirements for AFIT programs vary from program to program and are determined by AFIT's Admissions/Registrar Directorate. To volunteer for an AFIT graduate degree program, individuals must request an academic evaluation from AFIT/RREE. Further details as well as complete program requirements and course descriptions can be found in the AFIT catalog. ▶

Most Significant Article Award

The Editorial Advisory Board has selected "Making Sense of Spare Parts Procurement" by Lieutenant Colonel Curtis R. Cook, USAF, and "A New Indicator for Avionics Maintainability" by Jean R. Gebman and Major Jeffrey M. Snyder, USAF, as the most significant articles in the Spring 1990 issue of the *Air Force Journal of Logistics*.

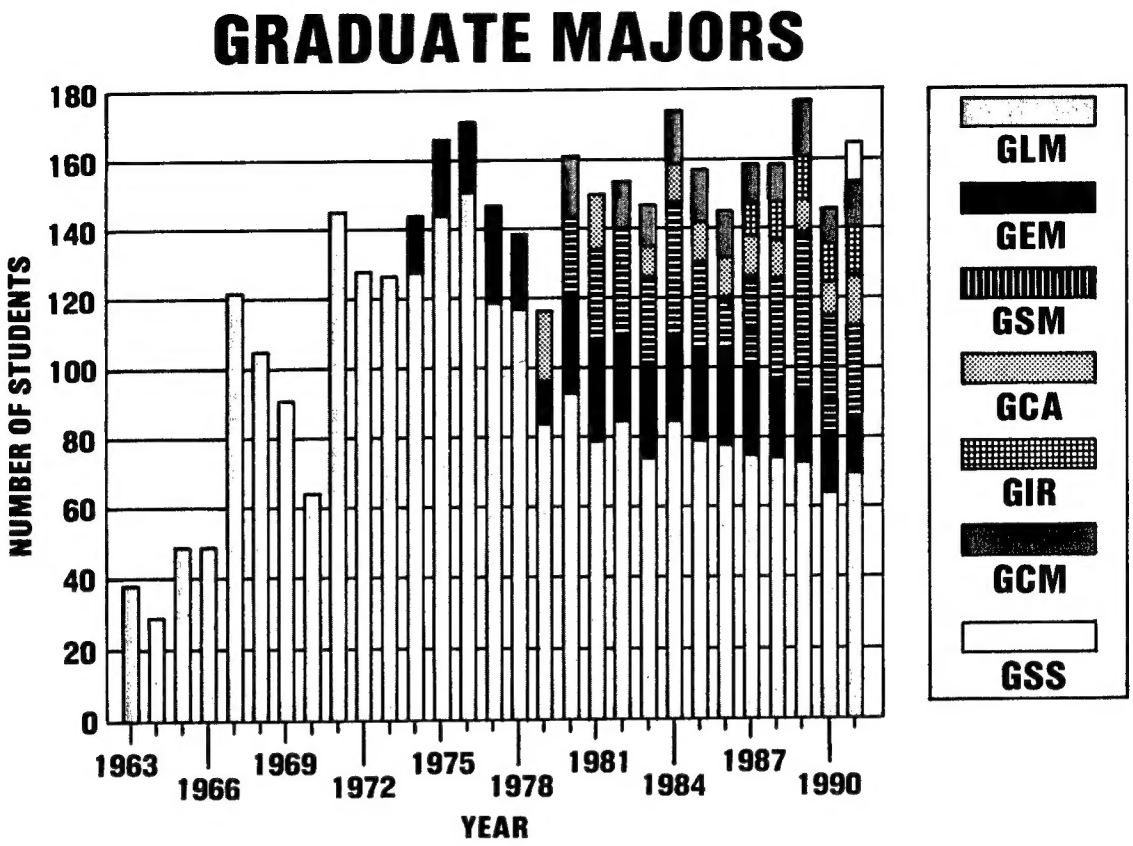

Figure 1.

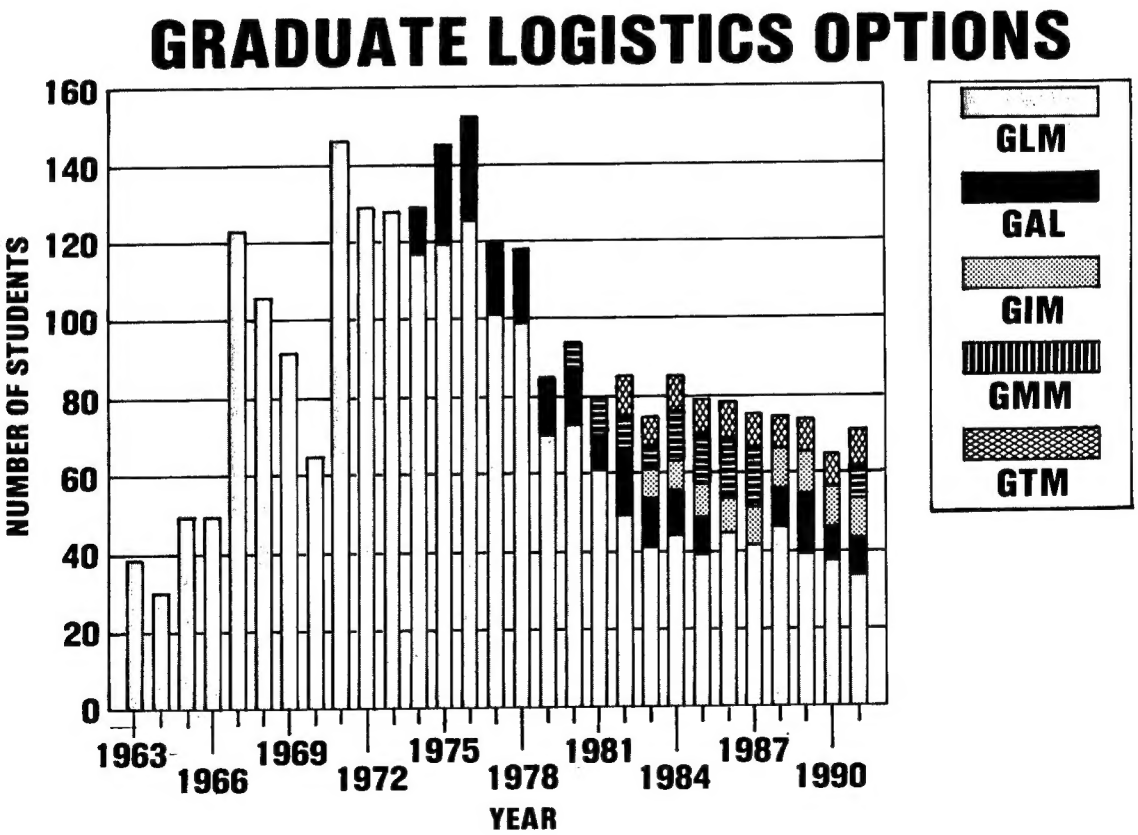

Figure 2.

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